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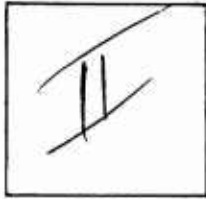
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(25-26 May 1978)

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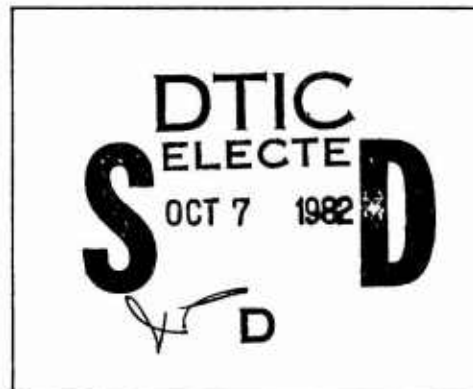
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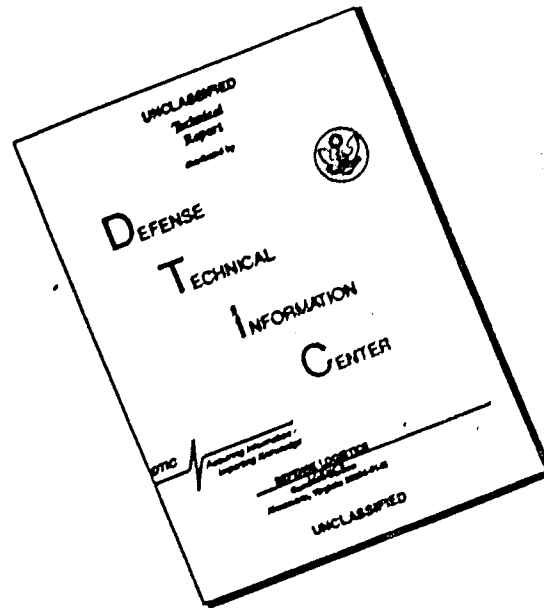


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PROCEEDINGS OF SEMINAR
ON AIR ANTITANK WARFARE
(MAY 25-26, 1978)

MAY 1, 1979

PERFORMED UNDER
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The views and conclusions expressed in the papers contained herein are those of the authors and should not necessarily be interpreted as representing the views of the sponsoring agency or Battelle's Columbus Laboratories.

The papers were typed from tape recordings of the two-day session and errors may have been introduced in the typing due to lack of clarity in the tapes. However, in the interest of expediting the printing and dissemination of the proceedings, only minimal editing was attempted, and apologies are extended to the authors for any inadvertent errors.

A paper presented by Wayne Coloney, "World War II Armored Operations: A Frontline Soldier's View", was not tape recorded and a copy of the paper could not be obtained for publication.

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PROCEEDINGS OF SEMINAR ON AIR ANTITANK WARFARE

May 25-26, 1978

Springfield, Virginia

INTRODUCTION

On 25 - 26 May 1978 a Seminar on air antitank warfare was held at the Springfield Hilton, Springfield, Virginia. Presentations were made by Mr. John Boyd ("Patterns in Conflict"), Mr. Wayne Coloney ("Armored Warfare a Frontline Soldier's View"), Mr. Bell (of HERO) ("Nature of the European FEBA"), and Mr. Pierre Sprey ("Countering a Blitz"). These presentations were followed by a question and answer session with former Luftwaffe Colonel Hans-Ulrich Rudel. Colonel Rudel was the most decorated German Officer of World War Two and had the distinction of destroying 519 Soviet tanks with his JU8F-"G" Stuka equipped with two 37-mm cannons.

All of the presentations, as well as the question and answer session with Colonel Rudel, tended to support the contention that control of the battlefield is not necessarily a factor of outnumbering the enemy; rather of disrupting his rational decisionmaking process and of exploiting the ensuing confusion.

AGENDA

Springfield Hilton
6550 Loisdale Road
Springfield, Virginia

25 May 1978

1300 - 1315	Introduction	
1315 - 1515	"Patterns of Conflict"	Col. Boyd
1515 - 1530	Break	
1530 - 1600	"WW II Armored Operations, A Frontline Soldiers View"	Mr. Coloney
1600 - 1630	"Nature of European FEBA"	"HERO"
1630 - 1700	Recap/Discussion	

26 May 1978

0900 - 1030	"Countering a Blitz"	Mr. Sprey
1030 - 1200	Col. Rudel Questions	
1200 -	Recap/Discussion	

PATTERNS OF CONFLICT

Colonel John Boyd

If we look back we find out prior to the FX and the lightweight fighter fast airplanes that we had a problem pumping energy. In fact the pilots said these airplanes behave like manhole covers. They started sliding out of the sky very quickly and we could not get very many of them back. So the notion developed that what we really want to do is to conserve energy or at least add on. However, that seemed like the right kind of notion but after we got these airplanes that had high thrust-to-weight ratios and good turnability we found that the pilots like to use it both ways--pump it in very quickly and pump it out very quickly. We find that there are large energy surges to gain in certain situations and also to drag it out as a basis for gaining advantage, and we will get into that.

The evidence is very compelling. We look at the pilots. We look at the evidence and even the simulations. We begin to see that information as kind of drive through what I call a second bullet. It is just that kind of a fighter. We want high aerodynamic G or a high aerodynamic lift. On the other hand, while you have that you also want to be able to get generate higher current rates and lower turn radii or G's as the case may be, positive energy rates. But--note the chalk that I put on here--not necessarily higher turn rates or negative energy--rates. In other words, there are times that we might want to flush it out very quickly for a given turn rate or a given turn radius. You see somewhat of a chop there. It begins to drive us down to the third bullet here.

This suggests a fighter that we can use to pick and choose engagement opportunities using the fighter pilot as an actor. In other words, he likes to have at least in some sense, control over the engagement. Also, he likes to be able to have the capacity to make a natural hook or a button hook turn. The idea being he would really like to get inside his adversary's maneuver space--force the other guy outside his maneuver space so he can use that as a basis for exhibiting aspects of that control. In other words, when he is on the defensive he wants to force overshoot. When he is on the offensive, he wants to stay inside and deny his adversary doing the same thing to him. But you will note, I will introduce a new term here, "fast transit", to depict that because when you are talking about a natural hook, what does that mean to an engineer or persons trying to lay that

out except the fact that he is trying to maybe get around in small circles. But they are very transient kinds of conditions.

When you begin to think about it you say, "Well you are talking about fast dynamics". But really a better word or better term would be a fast transient--one happening over a very short period of time. I use the word fast, fast in a relative sense--faster than your adversary. But you will note that I use this in a very specific sense relative to this maneuver so the idea occurred that maybe we should broaden that notion and maybe that idea of fast transient could be developed over much broader notions and if so what would that be? For lack of a better way, let us go into an idea of expansion and you begin to think about this a little bit. It starts to bug you--get inside your head. Pretty soon you realize that when we talk about fast transient we are talking about operating at a faster tempo or a faster rythm than our adversary. Putting it another way, we would like to get inside his observations, his decision and action time scale. We are going to have to go through an observation-decision-action loop. We would like to be able to go around that loop over shorter intervals of time than he will do. If we can do that the idea occurs that we want to appear ambiguous to him and we are going to force him into a position where he overreacts and under-reacts. As a result, we are going to generate confusion and disorder in our adversary's mind as well as his system whether it be mental, physical, or what have you. Now why does that occur? Let me give you a feel for it. Let us assume that we in this room are going to compete against an adversary and let us assume that we are going to be in a conflict situation. Let us further assume that we can operate at a faster tempo or faster rhythm than he can. And we are going to try to do him in and, of course, likewise he is going to try to do us in.

The idea occurs that we are his environment and he is our environment. He is going to have to adapt and react to us; likewise we are going to have to do the same thing to him. He is going to see us through the lens of tempo and rhythm. He projects his own reality upon the world. Likewise, we are going to see him through our tempo and rhythm but ours is faster because that is the way we set it up. He is not going to get a very good image of us, but we can get a rather precise image of him. The net effect is that he is going to see one image of us yet the real image can unfold somewhat differently. In other words, the psychologists would say he is not adapting to his world. He has a mismatch between

how he perceives the world and how it is unfolding. In other words, we are driving him bananas with a modern banana. As a result, if we keep doing that--sequencing it over time and getting inside his system--no matter what he does he is going to tend to get negative reinforcement. He is going to try to achieve a goal. He is going to keep getting further and further away from it. For our part, we will get closer and closer. Doubt and uncertainty will arise, confusion and disorder and if we drive it far enough, panic and chaos. Now is there evidence to support that particular idea? If we begin to look we begin to discern evidences such as this. One of the first things that comes to mind is the Blitzkrieg versus the Maginot line in 1940. We see this idea of faster tempo or faster rhythm in terms of the Germans versus a slower tempo in rhythm by the French and the British. What would be the impact of that tempo? Well, in any book that you pick up on this thing, one of the first things they discuss is how the Germans are going through these loops at a much faster pace, much quicker pace than the allies. The allies were trying to adapt. They kept getting this negative feedback. Pretty soon doubt and uncertainty began to emerge and confusion, disorder, panic and chaos developed. It has been written up. They talk about confusion and disorder, inability to cope. In fact there is a beautiful account in Fuller's book on the conduct of war where he has an account of a British intelligence officer. On the first day, May 10, the guy was very calm and everything was going beautifully. May 11 there was a little note of anxiety--May 12, more. By May 20 the guy was out of his mind. He has blown his mind. He has gone bananas. And you can look at French accounts of the same thing--that it went the same way and then toward the end they did not know how to adapt so they just went catatonic.

Let us go to the F-86 versus Mig-15 as they were used in Korea. Now let us look at those airplanes and examine the observation-decision-action loop. If you were to compare both the airplanes in terms of silhouette you would find that they are about the same size. The Mig is a little smaller and the F-86 a little larger so in that sense the F-86 was a little easy for the Mig to see. On the other hand, in terms of the ability to see out, the F-86 had an enormous advantage over the Mig. Overall, the F-86 pilots came to the conclusion that it was much easier for them to observe what the Mig was doing as opposed to vice versa. So you get a higher quality observation to be able to see sooner under

a very dynamic or a very transient kind of environment. Now let us skip immediately to the action mode. If we were to compare these airplanes further--this is an important point-- you would find that in terms of ability to climb and accelerate almost throughout the envelope, the Mig had superiority over the F-86. It almost blanketed the total envelope. You would also find in terms of turn rate or radius or G or whatever you want to use, that the Mig had the advantage for the most part. Yet we find that we got the 11 to 1 or somewhere between 10 to 14 in exchange ratio, not them. How do we explain it? It is very interesting.

At that time of course, so-called breakthroughs came out. If you will recall the F-86 came out with a high-powered hydraulic flight control system and later a variance, universal flight control system. The Mig had a lower power. Interestingly enough, the F-86 pilots found that if they would use a scissor kind of maneuver, flip from one maneuver mode to another, that they could shove the Migs forward, get in behind them and shoot them down. They not only did it in a two-dimensional sense but also in a three-dimensional sense. Why do I make a big issue over this? Because if you were to go back to World War II and talk to fighter pilots they said never reverse your turn. Do not reverse your turn. Dumb thing to do. Going to get in trouble. Probably get shot down. On the other hand in Korea the mode was to reverse your turn. Flip-flop the other way because they found through experience that when you start getting up to high pressures, high Q's or high dynamic pressures to flip the F-86 from one mode to another very quickly the Mig pilots were in there struggling trying to keep up. The net effect was that the F-86 pilots were making transitions from one maneuver mode to the other much more quickly than could the Mig-15. Both three-dimensionally and two-dimensionally. Couple that with the ability to observe, and we begin to see these things and begin to accumulate them. Then, if you want to throw in the reason why we were better, the fact that our pilots were better trained and could make better decisions. In effect, our people could actually track through observations to decisions more quickly than could their adversary. And even the pilots themselves, even Gentile himself in World War II remarked, as you start to get the edge, pretty soon this other guy is getting negative feedback, he starts doing random kinds of things. He is very confused. You just knock him right out of the sky. We see that kind of thing happen. Whereas we tend to emphasize the body count, those other things precede that.

Many other cases might be much more interesting. The Israeli raid--no details on it, just an example here. Among the information that came out on the Entebbe raid in 1976 is the fact that they were in and out in 90 minutes and you read the accounts of how the Africans were trying to adjust. Idi Amin and his people were trying to adjust and were totally behind the power curve, and there was panic and chaos. The Israelis were going through those loops very quickly. The other guy was getting negative feedback and just could not keep up. In other words the idea time becomes very important. If we really do want to generate a rapidly changing environment, let us hype up that environment the other guy has to see, make it very difficult for him to adapt in terms of these characteristics--clear observations, fast tempo, fast transient maneuvers, quick kill, and so forth. In other words, so we can get inside his time scale. On the other hand, we would also like to make it difficult for them on the other side of the coin. We would like to inhibit his ability to observe or make decisions relative to us. So we can cloud and distort his observations for decisions. The point that I am trying to make is that in some sense we want to compress the time scales in which we are going to be able to do things. On the other hand, we want to stretch out the time scale in which he is going to be able to do things. So open up his time and mash our's down. The idea is indicated here that we want to collapse him into a bag of confusion and disorder. And if we carry it far enough we can drive him right to panic and chaos. Because what is going to happen in some sense relative to him, if we are clever enough, we are going to appear ambiguous, chaotic, or misleading. Thoroughly try to drive him bananas and at the same time try to prevent ourselves from being driven bananas.

At the same time, we want to suppress and distort our signatures whether it be the size or the camouflage IR, radar or whatever it might be. In other words, make things difficult for him and stretch his time. As we are looking at airplanes, three notions come to mind here including the idea of having high speed relative to him. In other words, we are going to be able to out-cruise him. Air-to-air, high altitude. It might be supersonic cruise, lower altitude, as long as we have the capacity above him. We want to be able to change positions more quickly than he can in terms of speed. The other notion here is the idea of maneuverability. We already talked about it--rapid energy gain, rapid energy loss

coupled with those high turn rates or low turn radii. Obviously, once again high and low being above him. And another idea is this idea of high pitch, roll, and yaw rates. What I have shown you are three things. First is the notion of maneuverability. What are we talking about here? I like to call it agility. You think of a cat. You drop it and that quick it twists and gets on the ground. So in some sense you are talking about high pitch rates, high roll rates, and high yaw rates. You are talking about an agility measure. That kind of thing, and each one obviously feeding into the other. Kill mechanism once again, the idea of quick-shoot fire control. In other words, you do not want a lot of prep time--take all kinds of time to get ready. Get ready fast and then you do not want a slow weapon going up there very slowly because it gives the other guy time to react. You want that thing to hustle and cut down his reaction time. So you want a fast weapon too at the same time. So these are the kinds of things we begin to suggest.

Historical investigation---well, I already said what got me into this and a couple of my friends pushed me. I really did not want to get into this. I went into it with heel marks all the way. Now they cannot get me out of it and they are just as angry, but in any case I looked at the blitz. Can we look into the internal dynamics or the internal ways that that unfolds that causes this confusion and disorder or panic and chaos depending on how far you drive these particular phenomena. As a result of that I started getting at the first books and I found that it was very difficult to really get an understanding unless I went back further in history because when you start reading Guderian and other people right away they start appealing to previous events which I was not familiar with and they just use a couple of words which is the key word everybody knows if they have read it. So I figure I have to go back and understand the key work. So it drove me into this historical investigation. As I went into it I saw some other interesting phenomena--I began to see some strange relationships between guerrilla warfare and Blitzkrieg, so I had to pursue that too. What I am trying to point out is that I looked at it through four categories: I looked at war in general; I looked at Blitzkrieg; I looked at guerrilla warfare; and, for lack of a better word, I looked at dirty tricks, stratagems, ruses, and that kind of thing. Here are some of the sources that I looked through. I am not going to go through in detail but I want to point out a couple here in alphabetical order and there are three in there that were particularly interesting, particularly after I had

read some of the other information. One, of course, which I think is greatly misunderstood is Clausewitz's book On War or Treatise on War. There is a new edition out by Howard Brett. If you are really interested in it, it is a masterpiece. But you have to go through and you cannot speed read it through Evelyn Wood's speed reading course. You are going to have to go through the book very carefully, compare the front to the back, the middle to the front, and pretty soon a wave will begin to wash over you and you might even understand it. But you have to go through that.

Another book that I found very interesting is Sun-Tzu's The Art of War which we will talk about as I go through my presentation and one that I think has not been given due credit. I found it fascinating to see how the thinking has evolved. Then there is this one by Manstein, Lost Victories. I think that is a masterpiece and I think there are some very important lessons in there. For some reason it is not articulated or is not brought out and I think if you do not read this book you are not going to really have a deep understanding of how the modern German general staff worked or actually how that Blitzkrieg unfolded and the thinking that went behind it. It is not just a bunch of tanks going 50 miles down the road. So I think you have to get some understanding of it. It is really well written. There is some superb thinking there. There are others that I regard as interesting too, but I think you will see. You will see Sun-Tzu down here again in The Art of War translated by Griffin. We can give you a copy of it later on to look at, but I regard those three as important.

Now, let us drive through the historical part. When you begin to look at this stuff you begin to see or begin to note that people, whether they are individuals or if they become part of a corporation, a bureaucracy, or a nation, they like to survive. Not only do they like to survive, they like to survive on their own terms. Not with a club over our heads. The net effect is that you want to have some capacity for independent action or freedom of action. That tends to be your goal. I do not care whether you are talking about an individual or about a subgroup or a large group in terms of a nation state. As it turns out, though, if we live in a world in which we have limited resources and we have these goals, if we try to improve our capacity for independent action we may deprive somebody else or vice versa. We find that we get a conflict here. If we try to improve ours we may need resources to do that and deprive somebody else and vice

versa. I am not trying to etch this in your mind, but it is the kind of thing you should keep in the back of your mind as we go through this presentation. It leads to these kinds of questions: How do we realize such a goal by waging war, or, the part that I am going to be very interested in, does history give any insights or suggest any patterns for realizing this goal? And as I have already indicated, we are really going to devote a great deal of attention to the second question.

So with that in mind, let us pursue the presentation. Let us go back to 400 B.C.--one of the earliest treatises on war, and talk about this at some length. If we look at the Treatise on War by Sun-Tzu around 400 B.C. you get the impression you have read something important the first time you read it, but you are not sure what you read. One of the reasons is that when you read these Westernized Chinese ideas on war or philosophy, you learn that they talk in metaphors, analogies, and aphorisms and that kind of thing. You are technically oriented--that may make it a bit difficult to assimilate these oriental writings, but if you think about it for a while why things begin to come through. One of the interesting ideas that comes through is that he has a tremendous obsession with the idea of deception. The book literally drips with deception on every page. How you are going to hold your adversary and the benefits to be derived. As a matter of fact he makes the comment "All wars are based upon deception", but he does not even have to make that comment. It is very obvious as you go through it page after page. Another interesting notion is the idea of swiftness of action, speed, rapidity, what have you. This also goes through page after page. You want to deceive them and you want to be fast. As a matter of fact, he makes the point "The essence of war is speed or rapidity".

Another notion, and I think it is a very interesting notion and one which we might not have a good feel for, is fluidity of action. Let me illustrate it this way. He speaks many times of the idea that an army should behave like water going down hill. That you seek the crevices, the gaps and the voids. What is he saying here? You begin to think there are a number of things that come through. One, he is talking about the idea of trying to find a path of least resistance. But I would like to take a little broader context to look at--the idea of being able to adapt to your environment when he is talking about fluidity. You have to deal with the environment and to do it more quickly than your adversary. The other notion when he discusses fluidity is the idea of directing strength against

weakness So this notion of fluidity entails a couple of things--the idea of adaptability and the idea of trying to drive strength against your adversary's weakness, or at least denying him the same possibility against you. The idea of cohesion is also introduced in terms of communications where small groups have to learn to work with large groups and work in a coordinated fashion. Then he uses these principles in order to play what we call a dispersion-concentration game. He would like to hit with a concentrated force, strike at a dispersed adversary, and in a modern sense roll over and destroy them piecemeal. Or on the other hand, when he is opposed by a strong adversary, he wants to be able to disperse and deny his adversary an effective blow against him. He plays it both ways. It is nothing more than another manifestation of strength against weakness. Whereas Westerners think of two concentrations bashing against one another and bodies flying all over, Sun-Tzu has a completely different notion.

The idea of surprise. This is interesting. Normally when we Westerners speak of surprise, the emphasis seems to be on the input side of the house, you are going to get the surprise and everything is going to be wonderful later on. On the other hand, when you look at it through Chinese eyes, they do all these other things so that they can actually have surprise manifest itself. In other words, they tend to put the emphasis on the output side of the house--as a result of doing certain things you acquire or generate the surprise. Their idea of shock is very much the same as ours--the sudden blow or a series of sudden blows over a very short period of time. Then there is strategy. You have to get inside your adversary's organization--learn his strengths, weaknesses, movement, and intentions. In other words, get oriented to your environment. Understand what you are up against so you can adapt to it and also be able to shape that environment and make it difficult for your adversary.

Sun-Tzu is always talking about trying to shape his adversary's perception of the world. Why? Because he is trying to undermine his enemy's plans of action. Then he says that attacking an enemy's plans is the best policy. Strange as it may seem, I made this briefing a number of times, and you ask, "Well, how can you attack an adversary's plans". Well you cannot take an axe and chop it or burn it. The idea behind it is very indirect, a very subtle kind of thing. If you get inside his organization, inside his system, so you are

oriented to his environment and you can shape his perceptions of it, in effect you have altered his plans. You have undermined and are attacking his plans. Next he talks about disruptive alliances. We have heard about that--Julius Caesar's divide and conquer is another version of it. It is another aspect of strength against weakness--trying to get the guy piecemeal, except you are doing it maybe on a larger scale instead of down at the battalion or platoon levels. Finally, our third basis of attack is army. You should still do all these things at the army level so that you can literally shatter them and pull them apart. Finally he brings up the notion of attacking cities only when there is no other alternative and he has a long description of why you do not want to do that, and when you read that, it is the same today as it was then. Nothing has changed. The expenditure, the price is very high. Duck it if you can.

Sun-Tzu talks about a cheng and chi maneuver as a basis to throw strength against weakness. Now the question is, what is a cheng and what is a chi. You might even be able to explain it better than I can, but let me give you an idea. How many people here saw the movie Patton? If you recall in one portion of that movie--I think it was up before the American flag, I do not remember exactly when--he made the comment to the effect "What you want to do is you want to hold them by the nose and kick them in the ass". Everybody said ha, ha, funny. That was a very important statement he made because it really represents in a sense a cheng and a chi. The hold by the nose to get his attention and then the undisclosed movement to the rear in order to pull him apart. That is one manifestation of it. Let us go a little deeper. The idea comes out about the cheng and chi: You are talking about the cheng representing a direct move and the chi an indirect move, or the cheng being the expected and the chi being the unexpected, or the cheng being the obvious and the chi being the hidden. If you want to take it all the way, the cheng in a sense represents the deception, the chi represents the surprise. And it is not cheng or chi. It is cheng and chi. In other words, they go together. In order to generate a surprise, first you have to deceive the guy. Why do I make a big point of that--because I read it in German and other documents. They put the surprise before the deception. Yet, if you look at the evidence, you have to get the deception before you can generate the surprise. So the order is important. It is not cheng or chi. It is cheng and chi. You do not have one or the other; they tend to go together, and I do

want to make that point. If you can do that, and be very clever, then you can slam your strength against his weakness.

Let's press on and go up in time. If we look at some early commanders, and of course I have a very tailored list here, Alexander around 300 B.C., Hannibal around 400 B.C., Belisarius the Byzantine commander around 500 A.D., Genghis Khan around 1200 A.D., and Tamerlane around 1400 A.D. When you see the kinds of things these commanders did, you find that many were familiar with Sun-Tzu. Many of the things they did were in conformity, with the ideas of Sun-Tzu as we have already talked about. However, there is an important difference. The Western commanders tended to apply these ideas within the context or within the frame of a battle. In other words, a formal battle where they would play this idea of a cheng and a chi or deception and surprise, the swift move to the rear or whatever in order to whip their adversary. If you look at the Eastern commanders, particularly Genghis Khan, they played in full conformity with the ideas of Sun-Tzu. They tried to literally unravel their adversary prior to the battle or even to deny the opportunity of a battle, and sweep up the whole nine yards. So in that sense they were much more closely attuned to the ideas of Sun-Tzu. When you look at either one you see this notion that we already discussed, the idea of the cheng and the chi. Let us look at some examples. Probably one of the most famous battles of all time is the Battle of Cannae. Many history books, generals, privates, civilians, and others study it in one form or another. Here we have the Romans at the top of the screen and the Carthaginians under Hannibal at the bottom of the screen. The Romans very seriously outnumbered the Carthaginians. Hannibal took this very unusual disposition and in effect, seduced the Romans to attack this arch wherein he was greatly outnumbered. The Romans pressed this arch back into this view where this dotted line is indicated here. Hannibal, knowing that he had a cavalry that was better than the Roman cavalry, used part of his cavalry to drive off the Roman cavalry. The rest he used to put in this stopper. He had the Romans so jammed in there that they did not even have the space to use their weapons--totally ineffective, confusion and disorder. The result--the Romans were slaughtered. A battle of annihilation. I do not know the exact figures, but I think the Romans lost around 70,000--Hannibal somewhere around 2 and 3,000. A rather fantastic victory. But once again you can see the manifestation of a cheng and chi where Hannibal seduced his adversary. The point I want to make is that this happened within the context of a battle.

On the other hand, let us look at the opposite example, what we can call a strategic maneuver or strategic operation. In this case a move by Genghis Khan against the Persian empire. Here we see four columns going against the Persian empire. Now what it does not reveal here are the dynamics. One of the interesting points--note the scale down here--500 miles. So we see the distance between the two outer columns there, yet it is a coordinated move and at least we do not think they had avionics or electronics. So the question that occurs is, "How did that happen?" One, a lot of preplanning. Two, signals or signalling devices. Three, couriers operating between the columns. They came in against the Shah and the Shah's forces greatly outnumbered them. They made these moves--one column before the other. The Shah tried to set up his disposition. They would shift the columns. The Shah would try to change his disposition. They literally pulled them apart. In effect it was really one major battle. You could not even call it a major battle--it pulled them apart, forced the Shah to abandon his empire, disintegrated his army, and then they sacked both of the major cities--Samarkand and Bokhara. This is the kind of thing we call a strategic operation or a strategic maneuver as opposed to the so-called major battle as depicted by the Cannae move and we will be bringing this up as we go down further in time.

Let us move a little further along--18th Century wherein we will discuss these gentlemen--Saxe Bourcet, Gilbert, and DuTeil. This was basically their theme--mobility and fluidity of force, very much in tune with the ideas of Sun-Tzu. They also bring up the notion of cohesion wherein they recognized that they had to be able to work together and they would use these devices--mobility, fluidity, and cohesion--to play the dispersion-concentration game--to be dispersed initially, at the last moment concentrate so that you can have a piece of your adversary's force. The old piecemeal again. The strength-against-weakness game again. In some circumstances if he outnumbered you, you were going to have to disperse and give him something that he could not attack, the idea being obviously that you still have to be quicker than your adversary or you are not going to get away with it. Very interesting notion here of a plant with several branches, primarily attributable to Bourcet who made the point that you should not have just one branch. Have many branches. If you start going down one branch and you are frustrated there, ricochet off, go for another one. If you are frustrated there, ricochet off and go for another. In other words, you want to keep your

adversary off balance. Another manifestation of that idea of strength against weakness. Another idea is to operate on a line or between alternative objectives. If you start moving between alternative objectives, this will put your adversary on the horns of a dilemma. Which one is he going to defend? If he splits his force at the last moment, you can bang against one and hit a piece of his force.

There is this other notion of concentrating direct artillery fire on key points to be forced. In other words, mass your artillery fire and try to blow a hole right through. You see many of those things today. Later on I will show you how we can take these last three notions--plant with several branches, operate on a line against alternative objectives, and concentrate direct artillery fire--and bring them together in one notion. We will see that begin to come out as we go on here. Napoleon was very familiar with many of these ideas and he used them very effectively, particularly as a general and in his earlier campaigns to defeat superior forces. I use the word superior lightly because obviously he must have been superior, so I am talking in terms of numbers only. He was more skillful, more daring, and more clever. But that was the general. Later on in his campaigns as emperor he started depending upon weight, mass, and power to drive it right up his adversary's rear end and started pitting strength against strength. Obviously he wanted more strength. Battles of attrition. Decisive battles. As a result he was going against these regions of strong resistance and there were very high casualties on both sides. He won many battles that way, but eventually met his demise. Later on he said, "As a general Napoleon was an outstanding general. As Emperor Napoleon was not a very good general". So as he got the wealth of the state he went to mass, he used up mass just to smash his adversary. Instead of using the rake here he started using a club.

The American colonists, the Spanish, and the Russian guerrillas who use these same basic ideas--us against the British and the Spanish and the Russian guerrillas against the French under Napoleon. They always tried to pull their adversaries down by using strength against weakness. Often we tend to draw a sharp distinction between regular warfare and irregular or guerrilla warfare. I think there are some common things that take place in the two and you may get a more integrated or more whole viewpoint and bring out some subtleties you otherwise would not see if you consider them simultaneously. The point that I am trying to bring out here is that regular warfare and irregular warfare exploit the

same principles. It makes no difference whether you are talking about Sun-Tzu, Saxe, Bourcet, Gilbert, or others, their ideas are at home with regular or guerrilla warfare. As we go down through history we will keep track of this and see whether regular and irregular warfare diverge or tend to hold together in these terms.

Let us move up to the 19th Century. Clausewitz's masterpiece On War came out about 1832. I want to get a nice chart on Clausewitz and put it in my briefing, but to try to condense his essential ideas to one chart is a pretty tough job, and I want to do him justice. The one thing I do want to point out here is that when we read his works we realize that he has a very heavy emphasis on the notion of the decisive or major battle and he tends to underplay or puts an underemphasis on the notion of a strategic maneuver. The question is why did this happen? By looking at his works and trying to see what happened, can you tell why this tended to come out? You have to be very careful when you start to criticize Clausewitz because he is using a dialectical approach. On the one hand, he takes a very extreme view in one chapter, a few pages later he takes the opposite extreme view, and he goes back and forth trying to weave his way through his story. He is going through this duality or this dialectic where he takes his extreme views--absolute versus real wars, and so on.

One of the big notions that he has in his treatise is this idea of friction, uncertainty, and chance of war. He recognized that this is just something that is going to occur and one of the biggest jobs of the commander was to be able to overcome or at least deal with friction, uncertainty, and chance in an effective fashion. Today we call it confusion, disorder, chaos, or whatever you want to call it, that kind of thing. Interestingly enough, even though he goes through this dialectic, he does not come down on the other side. He really does not address the idea of trying to magnify his adversary's friction and uncertainty. Yet when you look at his works you find out that if he had done that you would begin to see some more positive aspects from strategic maneuvers because the kind of things you are trying to do in strategic maneuver is to generate that confusion, chaos, and disorder, or friction and uncertainty as he called them. In any case, I regard this as being the crucial difference between him and Sun-Tzu. Of course they wrote at different times. Sun-Tzu was trying to magnify his adversary's friction and uncertainty or confusion and disorder, whereas Clausewitz generally thought in terms of trying to overcome it from a

commander's perspective. In modern vernacular, Sun-Tzu was trying to drive his adversary bananas; Clausewitz was trying to keep himself from being driven bananas.

Let us move on and look at the 19th Century a little differently. The idea of technology began to show it's head--the railroad, the telegraph, the quick-fire artillery, machine gun, repeating rifle, and so forth. You will note what happened. We improved our logistics capability through the railroad and our communications capability through the telegraph. We also magnified the effect of firepower to deliver massive amounts and at the same time we developed a logistics network to serve that. The point is that we began to see solutions based upon firepower and the logistics to support it--like an incestuous feedback with more firepower, more logistics, more firepower, and more logistics. Battles of attrition took place, with incestuous amplification. We also note this idea that shows itself: the idea of a small holding force dug in to hold off a large force, with a flank or a real attack and a broad flanking maneuver. This is another example of Patton's "Hold them by the nose and kick them in the ass" in order to gain a decision. Lee, in particular, was very successful at that during the Civil War.

Yet, even with Lee and others we still see these frontal assaults, pour on the firepower, artillery barrage and everything else, pounding against reaches of strong resistance--battles of attrition. That kind of thing. Notice the basic result--huge armies, mass firepower. Because we had this we see a suppression of the ideas of deception, surprise, and mobility. Do not forget those railroads have to run on a track; they cannot run off and that is sort of a one-dimensional mobility. If you base your decision on firepower you have to build up these tremendous logistics bases, build up these huge supplies, and the other guy is watching. He has an idea of where you are coming from. As a result of that, your actions are not surprising. Putting it all together, here are the key points I want to stress. If you tie together Clausewitz's battle of philosophy and firepower, technology, and logistics, we find what I call Cro-Magnon warfare in a modern sense. The club is technology. We are going to beat the guy over the head with that club. We are using a crude club, technology, through the artifice of battle. And we see it in all these wars. We have probably had others besides the ones I went through--the Civil War and way down to World War I in 1914-1918.

I am not going to discuss each one of these wars. One of the interesting things though is that the Russo-Japanese War of 1904 and 1905 had many of those 19th century implements and we actually see a precursor or small blueprint of World War I. They had the trenches, the barbed wire, the machine guns, the artillery, even searchlights, and field phones. Interestingly enough, they also found that the cavalry did not prove too useful during the Russo-Japanese War. It seems that machine guns and barbed wire diminished the utility of the cavalry. There were many learned articles written between the Russo-Japanese War and World War I trying to defend the cavalry. It was not used right and all that kind of stuff. Then they tried it in World War I, they found out that things did not change very much. But interestingly enough, in 1939 we find out that the Chief of the United States cavalry (I don't know how he was forced into this response) was over in Congress trying to defend the cavalry. I forget the question but the response was like this: "We are going to make the cavalry more mobile by putting the horses in trucks." That is called defending the farm--from 1904 right up to 1939. Of course we do not defend the farm nowadays do we? That kind of thing actually happened.

Now, with that in mind, as I said I do not want to look at all these wars. Let us look at World War I because in a sense that is the grand focus of the Clausewitzian battle philosophy and the 19th century technology. You can break it up in about three phases, and many historians do this: plans and execution, the stagnation, and the finale. In the plans and execution phase we will talk about the Von Schlieffen plan and the French Plan. Basically, they unfolded and petered out between August and October of 1914. Very shortly after that the stagnation set in with trench warfare, and that really held pretty much until the finale, for lack of a better word, in spring or later in 1918.

In World War I the offensive was usually conducted on very wide fronts. Even though they might have had a columnar advance, like the Germans used in 1914, they still tried to maintain an evenness of advance. In other words, a column moving at fairly equal pace because they were very worried about the flanks. They did not like to get attacked in a flank. It was very dangerous. That slowed down the pace somewhat. The other idea was that they also wanted to be able to have artillery available so that if they were stopped they could keep the advance going. The third notion was that when they came up against strong points they

would commit the reserves against regions of strong resistance. Both the allies and the Germans and other people did that kind of thing, especially on the Western front. Not so much on the Eastern front. The reaction: They decided they could organize themselves in so-called linear defense, belts of fortified terrain, trench warfare, barbed wire, centrally directed artillery, machine guns. The idea was that if a guy tried to make the advance, you would dump in the artillery on him in order to break up the coherence of the advance. If he got in closer, pump in the machine gun fire, break it up even more and pin them down, and then finally the counterattack to throw them out. Many lives were lost. And then a few weeks later the other side would try the same thing. They were literally only gaining yards with a very high attrition.

An interesting case here on the firepower notion would be the British Battle of Somme in 1916. I do not know whether many of you people realize, but they had one week of preparatory barrage before the British infantry moved out. One week; they were going to blow everybody away, have the big breach there and go on into Germany. Of course they wanted to have the big breach there so the cavalry would have something to do too. But in any case, that was the idea--firepower is simply a firepower solution. So what happened? As they tried to move in behind the barrage the British had 60,000 casualties on the first day--60,000 casualties. They have never forgotten. Well, you would think that maybe the Germans after a couple of days would suspect that something was going to happen in this portion of the front when the artillery was being delivered at such a high rate and so obviously they were going to switch reserves behind the front, plus they had already had artillery barrages before that so they had a lot of bunkers dug in very deep to try to minimize the effects of the artillery barrage. They did all those things and of course the British paid very heavily for that, with many, many people lost.

As I indicated, you look at that you see the stagnation and this enormous attrition. Why? Because these people knew pretty well where the advances would come from. When you start building up millions of numbers of artillery shells, huge supply dumps, and the other guy's agents or recon people are watching that, they get the notion that something is going to happen. So you have these people waiting at these regions of strong resistance and the net effect is huge battles of attrition. You could use up a couple hundred thousand men and gain maybe a

mile or two or even less. Now this is principally on the Western front. On the Eastern front, some of you are familiar with Von Hoffman and Ludendorff at Tannenberg which was in a sense a modern Cannae.

How do you duck around this? It turns out that the idea of infiltration tactics was put forth. There were others who were responsible for it but three names come to mind--the French Captain LaFarge, I think it was around 1500 or 1600, wrote this pamphlet titled Infiltration, which went up to the Allied high commands and German agents got it. It also went up to the German high command and eventually reached Ludendorff's desk. The Germans were working the same problem at the same time of how to get through these linear defenses. How can they penetrate? How do you go about it? And so when he saw that plus their own works the idea of the so-called infiltration tactic was discussed. Another gentleman's name that is attached to that is General Von Hutier sometimes called the Hutier Tactics. Modern historians tend to agree, though, that he might have done that but he really was not the originator and that is why I have a question mark after him. I do not want to get into that fight between the historians whether he originated it, but you will see that going around. I think the modern consensus of the historians is that he was not the originator. Of course, General Ludendorff, the German general, implemented in four or five drives on the Western front these infiltration tactics. Then there were the guerrilla tactics as seen through the eyes of Lawrence--many of you have probably read his book Seven Pillars of Wisdom or The Arab Revolt and Encyclopedia Britannica 1929, 1927, or thereabouts, and the Germans down in East Africa know Lawrence is a very clever writer, very articulate, very sharp, and he was very successful in many ways, but he did have a great deal of outside help. I think that made his success possible, whereas Lettow-Vorbeck down in German East Africa was left pretty much to his own devices. And it is pretty much a modern consensus that even though he did not explain it very well, he seemed to be the better of the two. In other words, the best guide is not necessarily the more articulate person. As a matter of fact, you find that with only a few hundred officers, a couple thousand Germans and some Africans, he held off between 250,000 and 300,000 British troops and I think roughly 30 British generals and I believe at the time he was a Lieutenant Colonel. He surrendered after Germany did in World War I. As a matter of fact

he was even making his ersatz gasoline in World War I. A rather outstanding individual. But since he was not very articulate, when I looked through it I had to look through Lawrence's eyes. I do not have some accounts on Lettow-Vorbeck.

Let us look at infiltration tactics and you will note that I will be looking at things in a little more detail as I move up to the present time. Basically, it went like this. Instead of having one week's artillery bombardment, maybe two or three hours in which they also used smoke and gas shells with the idea of trying to obscure what they were trying to do, make the movement of their adversary a little bit difficult. So they are trying to suppress the defense and obscure the assault. Then they would send in this specially trained infantry or special team which the Germans called the Sturmtruppen or in English I guess we would call them Storm Troops, but instead of coming in these huge waves trying to pour over the defenses they started dancing in small groups of platoon strength--real low level fire and movement. The idea was to try to get through the crevices, the gaps, the voids in the defense. In other words, seep in or infiltrate. Try not to hit the strong points, press on, and work their way through. As a matter of fact, they were given instructions "Don't worry about your flanks. Just keep going". Instead of trying to set their pace to the guy on the right or left of them, each guy was to move at his own pace. As a result, they were independently providing support for one another as independent units. Very small, low level. Equipped as indicated--grenades, light machine guns, and so forth. The idea once again was to avoid the opposition, then send in these follow-up teams which the Germans call the Kampfgruppen or battle groups, and they even used this word during World War II. What they would do then was to pour through the gaps to reduce these isolated centers of resistance. These were not centers of resistance that were being fed from the rear, which would make for huge battles of attrition, but isolated centers of resistance which were left after they had cut their linkages to the other units. Then, of course, the reserves were sent in to feed both these operations, because you had to keep feeding not only the Sturmtruppen but also the battle group, the Kampfgruppen. You funneled these reserves right up the breaches and gaps that they had created. The purpose was to go through paths of least resistance or to support success, not to try to redeem failure. The idea was to drive these fingers or stilettos in the other guy's front, envelop him

from behind, collapse the whole nine yards. An envelopment game. So we see a completely opposite notion to the one that prevailed in the 19th century. Also, instead of seeing these huge waves operating, even when they had large groups of people available, they operated in small groups trying to work their way through these voids or gaps. Strength against weakness.

How did it work out? Well, fairly successfully at the platoon company and battalion level, but ultimate failure at the corps and army level. Here are some of the reasons why. Even though Ludendorff seemed to start out right, at least seen through Liddell Hart and others, later on he seemed to start burning his reserves against these regions of strong resistance. I want to comment more on this. It is not clear that this is exactly what happened. In any case, it has been stated that Ludendorff, started out right, then started switching reserves and going against strong points, thus blowing his reserves away and seemed to be reverting back to type. The other thing, was the exhaustion of the combat teams leading the assault. Do not forget this is kind of a new thing. Rotations and all that had not been worked out. Those Sturmtruppen got very tired and that tended to make it fall apart. A very important thing is this idea of logistics. Do not forget that they were going over those battlefields that were all torn up and they only had horse carts and that kind of stuff. They just could not keep pace with the assault to bring up the artillery, supplies, and so forth. They did not have logistics or the gasoline engine to support that kind of thing, plus the terrain was all torn up. Another very interesting thing is this idea of communications. They did not have the communications that they had later in World War II and such as we have today. Without the communications, after they started making their advance and they were trying to support these breaches or gaps that had been made, how could the commander at the rear, Ludendorff himself or subordinate commanders, know who was succeeding unless somebody was telling them. Where were they to get their information? There would be some confusion in the German line as to where breaches and gaps were that they should serve because they did not have good information on who was succeeding or who was not succeeding. They might have diverted the reserves to the wrong area.

The idea of the elastic defense, principally developed by the Germans but applied by Pétain and a few others, was not used very often to undercut or slow down the German offenses. The basic idea of the elastic defense was to

come back and get outside the German artillery and the German Sturmtruppen and come out from behind and if they could not bring theirs up, dump in artillery and pinch off the flanks with the Allied troops, instead of trying to defend every foot of ground.

In guerrilla tactics, as you have seen through the eyes of Lawrence, the idea is to gain support of the population. We hear this through Mao and others today. We talked about this idea of trying to arrange the mind. It is a quote right out of his Seven Pillars of Wisdom. Trying to arrange the mind of friend, foe, and neutral alike. He did not say exactly friend, foe, and neutral alike. He said it a little bit differently, but that is what he meant. So you see that this notion is very close to what Sun-Tzu was talking about. That is why I want to bring it out. This other notion he talked about, you see it in many historical references. Many historians use it this idea of behaving like a gas. He is not talking about behaving like water. He said to behave like a gas--and drift about like a gas and be more delicate than the notion of water. Not only the notion of fluidity, but the idea of not being obvious or inconspicuous. So it is a more delicate notion of fluidity and he also talked about an attack in depth, but not the same as we talk about today. In that case it was a distributed attack against his adversary, while today an attack in depth is thought of in terms of a deep, narrow penetration. Also, instead of hit and run, he talks tip and run. The delicate notion again. Do not use force. Do not try to ram it down their throats. Hit them, back off. Hit them, back off. In other words, try to avoid the battle of attrition; do not get involved in attrition games. Then there is this notion of using the smallest force and the quickest times and the furthest lengths. He very often used these terms. Quickness. Which suggests that he was trying to get inside his adversary's system, whether he said it that way or not. He also wanted to have a war of detachment. Even though you are not everywhere, at least your adversary should perceive you as being everywhere. So you can fragment or disperse his force and when he does not want to do so. As a matter of fact, one of Lawrence's strategic notions there with regard to the Hejaz railroad, between Damascus and Medina, was that he did not want to drive the Turks away from the railroad. He just wanted to make them so uncomfortable they would use their forces and use their supplies very badly. In other words, he wanted them there, but he wanted to be a pain in the neck to them all the time.

He felt that if he drove them out they would be able to unify elsewhere and he really was trying to keep them separated just by keeping the pressure on all the time. That was one of his strategic notions. In any case, he applied the ideas of mobility and fluidity of action and using the environmental background for cover and concealment. In the case of Lawrence it was the desert. At that time it was very easy to hide in, but not so easy today, perhaps. He was trying to ultimately throw the Turks out of Arabia. Disintegrate the ability of the Turkish adversary and regime to govern.

Whether you look at infiltration tactics as seen through Ludendorff or at the guerrilla tactics of Lawrence, you begin to see that same theme again. I do not care whether Ludendorff had more forces and Lawrence had fewer forces, we still see this notion of fluidity, and we see this notion of cohesion of these small units. Remember that in the infiltration tactics Ludendorff used small units of platoon size to get through even though he had more forces. There are great differences between the two obviously--different levels of concentration. Ludendorff could generate higher levels of concentration. But the notion, the theme, is still the same.

Let us move up to more recent times. We find that during World War I there was a gentleman by the name of J.F.C. Fuller, British, I believe he was a major at that time, who observed these infiltration techniques that the Germans used against the British and he saw the panic and pandemonium, the chaos that occurred in the British lines as they started collapsing in front of the German assault. Now you have to understand even prior to that Fuller was very much interested in how to use the tank and he actually laid out some plans and some drives for the tank in World War I. It occurred to him at that time to take those infiltration tactics and mechanize them. In other words, instead of just people wiggling their way through, they would mechanize and use these motorized vehicles of mechanized infantry plowing through. He came up with some of the original ideas of mechanized infiltration. Today we call it Blitzkrieg. It is seen through the nose of the tank, motorized artillery, tactical aircraft, transport, and obviously better communications.

Then there came another gentleman by the name of Heinz Guderian. He was a signal officer during World War I and he recognized the problems he had with communications. He read these pamphlets by Fuller, expanded upon his ideas, and, as a matter of fact, I do not know whether you know it or not, Guderian did

not see his first tank until 1929, while Fuller had been working with tanks from about 1916 or 1917 onward. Guderian did not even see his first tank, but he had read Fuller's pamphlets. Since Guderian was also a signal officer, he came up with the extraordinary and radical idea that you should put a radio in every tank. Of course, everybody said that was ridiculous. Even so, he elaborated upon Fuller's idea. Fuller was one of the initial people that came up with the idea. Guderian was the first one to make it work. The result is indicated here-- Blitzkrieg. Blitzkrieg really is a mechanized variant of the infiltration tactics that the Germans applied during World War I, and it evolved from Fuller through others. You will see other names associated with it--Liddell Hart, Charles de Gaulle, Martelle, and others. In any case, you see these breakthroughs on a narrow front through very small regions. Maybe only one or two kilometers wide, leading off with a division, motorized infantry, and followed up with the foot infantry division and supported by tactical aircraft. The tactical aircraft do two things-- local air security plus support the ground troops.

Guerrilla war as seen through the eyes of Mao. Basically he did not come up with any really new nugget, per se, but what he really did was to systemize or codify or put together a lot of the ideas which many people had previously put forth regarding guerrilla warfare. One idea he did come up with was total war: political, economic, social, and military. One interesting thing is Mao was very familiar with the ideas of Sun-Tzu. He was also a student, a great follower of the ideas of Clausewitz, plus he obviously learned much from his own experiences. So when you read his works you really see kind of a synthesis of the ideas of Sun-Tzu, Clausewitz, and his own experiences.

If you were to look at this part of the chart, we talk about total war and we look at this in the tactical sense, it would give the impression maybe that guerrilla warfare is more general than Blitzkrieg. I do not want to leave you with that impression because there was also another person by the name of Adolf Hitler who was familiar with these techniques and he did not think of it just in terms of a tactical or grand tactical sense, but also in a strategic sense as a vehicle for total war. Both these things were used in a total war context. With that in mind, let us track down through a Blitzkreig-guerrilla strategy. I want to reemphasize the point that whether you are talking about Blitzkrieg or about guerrilla warfare, their modus operandi is infiltration. One is mechanized and the other is

not, and they work against all aspects of the regime--political, economic, social, and military. You look at many of Hitler's statements and you say "My God, he must have read Sun-Tzu or at least been briefed on it". His statements are almost exact quotes from Sun-Tzu. We know he was familiar with Clausewitz. In any case, the idea is to get inside the adversary's systems and know his strengths, weaknesses, his maneuvers. When I talk about maneuvers here it is in a very broad sense. Not just physical--stratagem, ruse, and obviously his intentions, always trying to shake your adversary's perception of the world so you can unravel his plans and his actions. Try to get him to do the wrong thing or have him perceive what is happening the way you want him to perceive it. Shape his perception of the world so you can manipulate or undermine his plans and action. The purpose? To put that external pressure on plus the inside pressure. Shatter the whole system and make it come unglued. Both Hitler and Mao liked to do it. If you have to fight, they are so weakened they fall apart. They come unglued. Any success? Example: What about Austria in 1938? Czechoslovakia in 1938? Even when they had to go against Poland they went through very quickly. And what about France in 1940? Same things. In other words unravel your adversary. Get that strength against weakness. That sort of strategic aspect.

Now let us look at it from the operation or tactical aspect and we will separate it out. This is a fairly detailed chart of Blitzkrieg. I want to point out a number of things here. This subtitle is action. This one down here is idea. But the Germans very definitely depended very heavily upon their intel and reconnaissance activities at all levels. Intelligence and reconnaissance. They wanted to get inside their adversary's system to uncover strength, weakness, moves, and intentions. You want to understand what is going on in a tactical sense, and you will note an interesting word here--"Schwerpunkt" or "point of main action". They would base upon this information and establish that point of main effort, then shift it during their combat operations. The idea being they were trying to drive through with their strength, bypass their adversary's strength, and drive right at his weakness. If you want to say it in the words of Sun-Tzu: Avoid strength, flow through emptiness, strike at weakness. Then there are those other points. I did not know what the word was, so I talked to some of my friends here who are very familiar with German--it is Nebenpunkt, or those points of secondary or other efforts, which they would use to tie up or drain away their adversary's strength.

They were playing two kinds of games there: the point of main effort, or schwerpunkt, and points of these other efforts, nebenpunkt. This was not just a thrust point or prongs driving into some adversary's front. That is one aspect and that is one facet of it. It turns out, as I will show you in a minute, there was a unifying concept of the Blitzkrieg which was articulated in an initial sense by Clausewitz in his On War in 1832 and I will get to that in a minute. It is a very important concept and if you do not understand this you do not understand Blitzkrieg. In any case, then, once they set this up they began to make their moves using their firepower--indirect and direct firepower. For the Germans, "indirect" was for interdiction and "direct" was their close air support. The idea here, and they coupled that with artillery, was to do a number of things. One, to impede or channel their adversary's movement. Obviously, they wanted to channel it to their advantage. The other things include trying to disrupt his communication, suppress his forward defenses, and obscure the advance by the way they use their artillery, the way they use their air power or smoke, shells, or whatever they do. Very important ingredient. Then they used their recce or storm trooper teams to find these voids and gaps, and infiltrate the front. The basic idea is to find these paths of least resistance for the follow-on effort. So they filtered through and then behind them, and with the information they provided, these armored assault teams, which the Germans themselves even in World War II call kampfguppen or battle groups, containing tanks mechanized infantry, combat engineers, antitank assault guns, and so forth, supported by the air, went through and ripped or breached and widened these gaps. They tried to go along or against these weaknesses. Then when the breakthrough occurred, mobile armored teams led, by the armored reconnaissance, would blow through deep into the adversary's rear. Their basic idea, once again supported by the recce, fire, and air lift, when necessary, was to cut the lines of communication, disrupt movement, paralyze the command and their support activities. Behind them would come the motorized or foot infantry which was to secure the gains against counterattack or complete envelopment, whatever the case might be.

Here you see an orientation phase first. The Schwerpunkt in some sense is the intention. Here is the preparation. Here is the infiltration. Here is the penetration. Here is the exploitation. Here is the consolidation. A very systematic fashion. The idea was to conquer a region in the quickest possible time. Generate that initial surprise. Use the very fast tempo and fluidity of

action to bring that surprise over and over again. The guy is always behind the problem. Cannot keep up. Just pour it on them. Bingo. Bingo. Bingo. Keep it on all the time. He cannot catch up. And they direct that effort then against the guy's communication, command, and support structure. The idea is make the whole thing just fly apart.

Now, we have a problem. When you look at it, they also trust to their lower level commanders. Give them a high degree of independence to operate so if you give them independence, the whole thing could fly apart. So how do they even keep the Blitzkrieg together, keep it from flying apart? If you give your lower level commanders a lot of independence, they all start doing their own thing and pretty soon you might have a comic opera going on there. With that in mind let us get back to that notion of the schwerpunkt. If you look at the schwerpunkt and you start reading the German accounts you find out they use this over and over again. Well thrust point. They do not have to tell me. I understand it. But you really begin to see that there is something much more involved intuitively understanding some of the things that come out. One of the ideas that is implied is a dramatic thinning out of force and effort in other sectors and the reason they are trying to generate a local superiority. They use the words prior to World War I--the tactics of "surface" and "gaps". They recognized that they had to have gaps and voids in order to generate these schwerpunkt. They are applied at all levels from platoon to theater. In other words, the platoon will have a schwerpunkt. A company will have a schwerpunkt, a battalion, regiment, division, corps, army, group, theater. So you have schwerpunkt inside schwerpunkt. They applied at all levels. The other notion is the center or axis around which they maneuver using fire and movement of all arms and supporting elements. They even talk about a schwerpunkt for their logistics effort. The air has a schwerpunkt. And even their personnel. All supporting elements. The idea is to focus those things in order to exploit those opportunities and maintain the tempo of operation. So it is a center or axis around which these things are focused. Then we can actually mesh together the initiative of the tactical level with the intent of the strategic. In other words you do not go down to the name tag and tell a guy what to do. You communicate to that schwerpunkt. And that is how you glue it together. So it acts as a glue in order to hold that Blitzkrieg together so it can function as intended.

The final point here is that a buildup does in fact turn out to be a unifying concept of the Blitzkrieg. They can actually provide the way to focus that effort to harmonize as well as focus those support activities with combat operations, whether it be communications, logistics, or whatever. As a result, it does permit them a true decentralization of tactical command within the strategic guidance. I did not use "control", although that might be the right word; the reason I use guidance is because when we Americans use control it is very rigid and they are not talking about a rigid control. It is an indirect kind of control without losing the cohesion of the overall effort. So it is a unifying glue. It turns out to be a unifying concept of the Blitzkrieg. It is not just a thrust-point or a prong going through the adversary's front. It is a very important notion.

Let us go into it a little bit more. Here is an impression you can get out of it. You notice it looks like lightning. The impression of the Blitzkrieg, it is just an impression overexaggerated, but in any case the idea is to have these forward thrusts in a narrow front, two or more, where they are going to thrust through. As they start working their way through, they do not just go straight through. They start zig zagging their way in order to go against weakness, as a result of these paths uncovered by the armored reconnaissance. So they are trying to zigzag their way through. Then, at the same time as they start working through in order to collapse the front, they start making those lateral movements, and they also zigzag laterally, which the Germans call a "roll out". The idea is to start cutting those communication links between the enemy's forward strength. The interesting thing, whether you are talking about these columns going forward or these roll outs going to the sides, they do that at all levels. They will have the roll-out at the platoon, company, regiment, and so forth. You see flying column inside flying column inside flying column. You see roll-out inside roll-out inside roll-out. They not only have Schwerpunkt at all levels, they have these other activities working at all levels. They start cutting these connections, then that previous strength just dissolves away into nothing. They shatter their adversary's cohesion. It would be the same thing if I came up to this gentleman and took some scissors and clipped some blood vessels, clipped his nervous system, and clipped his tendons, I would turn him into a bowl of jelly. What I am trying to tell you is that it is organic warfare or look at it as a biological organism. You start cutting those linkages--jelly. They do it not only in terms of penetration.

When they are in the exploitation phase and they break through, they play the same game. They keep zigzagging their way through once again led by the armored recce units. Once again they start driving these wedges or these spearheads both in and laterally to dismember the organism so they can treat it piecemeal.

What is the result if you start playing this game? Let me give you some examples. Poland, 1939. Hitler had 40,000 casualties of which about 8,000 were dead. The Polish had roughly 800,000 of which a little less than 600,000 were prisoners--the rest were in other categories. Belgium, Holland, and France, 1940. Hitler had about 156,000 casualties of which around 35,000 were dead. The allies had roughly 2,300,000 of which about 2,000,000 were prisoners. If I throw in Norway and Denmark, add another 5,000 casualties or maybe less so what I am saying is that for roughly 200,000 casualties he took over Poland, Norway, Denmark, Belgium, Holland and France. That is a low investment. The allies had around 3,500,000 casualties, of which almost 3,000,000 were prisoners. Now that is interesting, because we do not have any models today that measure how you capture prisoners. They are all PK or body count models or expected values which are nothing more than an accumulation of body count. So if they cannot measure that phenomenon that generates prisoners I am saying that any model we have that is not a Blitzkrieg is attrition warfare. It is the only thing we understand, so that is why we do it. I want to see the P sub C, P captured or P prisoners. You analysts think that because you have this body count you think you understand Blitzkrieg. I am telling you, you do not do us much good either. I will get to that later. You do not understand it. There is a phenomenon that is taking place here. They are half out of their mind. They are bananas. Just read the reports. They are glad to walk in the POW cages. They are putting barbed wire out in front of 50,000 guys and nobody does anything. They just sit there. Glad to be there. It happened. That is not the battle of the Somme. Now here is the way you normally see it; this is the typical impression. It could happen.

If you look at the Blitzkrieg you see this kind of phenomenon taking place. You see the envelopment. We showed you Cannae. This is a playback to Cannae. Flying columns, that is a playback to the Mongols. The infiltration, a playback to Ludendorff. The tank attack or mechanization--a playback to Fuller and his contemporaries. What Guderian did was just to take all that stuff and suck it together into one concept called the Blitzkrieg, plus he added his own

wrinkles. Narrow front, armored recce, very strong emphasis. Panzer commanders forward--in other words they did not sit back at a chateau, look at all the lights and all the information, and then decide where they were going to go next, because those opportunities are very perishable. If there was a void or a gap there, their commands were expected to shoot it. So their commanders were forward. It is a very dynamic ball game. You have to have the information. Have it now. Act now. Extensive communication, both laterally and vertically, so the thing can play. Then of course they use the air in lieu of or with artillery as the case may be. You see these envelopments at every level. Platoon, company, battalion, division. Envelopment inside envelopment. Flying column inside flying column. You have to think of it in that sense. And those strong points are gone. The strength just fritters away. The key to their success--I have already pointed it out, and I want to stress it again, the idea of the schwerpunkt to do these things: focus, shift, and harmonize organizations support at all levels. It is the central glue that makes the whole thing work. The operation was heavily dependent upon intelligence and recce activities at all levels.

The idea was not only to understand their adversary's strength, weaknesses, moves, and intentions, but also to shake them and to cause them to do the wrong thing. The idea of initial surprise. If they have done all these things, they are going to get it. They not only want to get that initial surprise but to keep that pace going very rapidly, this fluidity of action as we have already talked about. So they can generate that surprise over and over again. The idea being to slam that strength against weakness, start generating that initial doubt and uncertainty, very quickly transforming it into panic and chaos, the big prisoner of war bag. The decentralized command once again based upon Schwerpunkt where they actually give their lower level commanders this freedom of action so they can shoot the gaps. They can shoot the voids. Take advantage of opportunities. The idea is superior mobile communications in order to maintain the cohesion and to reallocate efforts or reserves wherever you have to shift that point of main effort to every now and then. Keep the thing working. Always plan it back and forth. Then your logistics. I guess if we Americans would try to run a blitz we would be shipping up the PX and the swimming pools and everything else first. So I am not really thinking that way. Essential and only essential. Only those things you really need. In fact, I read a recent German document. It said, "We want to give them all they need, and then we are going to take

away all that hinders them", which is the same thing. I like the words. We are going to give them all they want, but we are going to take away all that hinders them.

Now to the modern guerrilla campaign. I do not want to spend too much time on that because we are not really going to be into that here but it does apply. Once again, the idea is to drive a wedge between the institutions and the people. That is the guts. How they are going to do it—try to bring out the corruption, the unfitness, inability to govern, try to get the people on their side, start setting up their administration, military organization, sanctuaries, and the political guerrilla leadership without arousing the regime's intelligence and security apparatus. The big important point—to get inside the other guy's system. Infiltrate his system—both political and military—so they can understand what this system is up to, fragment it even more. Then disrupt the political and military organizations by rallies, demonstrations, that kind of stuff. The big idea again is to demonstrate the unfitness of the regime. Get more people over on their side and then of course use these tiny bands to slam against these lines of communication. It not only gains army supplies but also can contribute to that disruption, by denying communications, coordination, and so on. When they are faced with a strong force, disappear into the weeds. Employ these methods in order to expand control and develop base areas. The things that we are talking about here, encourage the government to indiscriminantly take harsh antipopulation measures, reprisal measures, once again to get the people on their side. Also some of their own so-called re-education measures. Finally, they get to a level where they have larger groups. They can start harassing major government concentrations, not just going strength against strength, but front, flank, and rear, and, of course, when they face the heavy assault, disappear. Finally they reach a stage where they can take them on under their own terms and fragment the whole organization. The idea is to defeat an existing regime politically by undermining their ability or right to govern. Whether they have a piece of paper or not, if the people do not believe it, it does not take. The right and ability to govern and play these other games and cause the whole thing to come unglued. We do not seem to really get into the key to their success too much. We always start out where we are going to beat them militarily, but we do not pick at some of the heavy factors which we will get into later on. Anyway, try to alienate the government

from the people. Use their environmental background, the fast tempo, at least in their sense, so we can slam that concentration against weakness. It is first in the face of strength and Mao is always talking about shifting that effort which is analogous to the blitz. That is what he is trying to do. Retain the initiative. Shift the effort in order to retain initiative. And then of course in support of the population in base areas and expand those in order to expand their efforts. In any case, that is their theme whether you are talking about the blitz or the guerrillas. Their essence is that they just keep pounding on, with surprise and shock followed by surprise and shock over and over again.

The idea is to avoid battle. How many battles do you hear about in France? You talk about the Battle of France. It was a rush through. You do not hear about battles until you get to Russia. I will comment about that later on. In any case disrupt connections, centers, and activities to provide that cohesion, whether it be lines of communication, command facilities, or supply centers. Once again, I am talking about clipping the blood vessels of the organism or the tendons or the nerves. Collapse them into jelly. If you do that, you just roll up the isolated resistance. What is the intent? Is it to kill? No. Here is the intent--to shatter cohesion, produce paralysis, and bring about adversary collapse by generating confusion, disorder, panic, and chaos. That is the intent. Here is an example. The Israelis concentrated on disrupting connections and centers in 1949. Yadin said that in order to exploit the principles of war, you want to cut your enemy's lines of communication and thus paralyze his physical buildup. Seal off his lines of communication thus undermining his will and destroying his morale. Hit his centers of administration and disrupt his communications thus severing the links between the brain and the limbs.

As for the blitz, I do want to point out the unsuccessful. The successes went from Poland through the advance through France, Patton's advance through France, the Russians in Manchuria, the Middle East when the Israelis got their act together back in 1973. Unsuccessful--Russia winter of 1941-1942. Of course we recognize that they lost their mobility, were not ready for the winter war. So it shut down their operations. Without mobility there is no blitz. If you cannot move, you cannot blitz. Russia--fall and winter 1942 and 1943. They changed the game. I am referring to Stalingrad and the Caucasus. Their Schwerpunkt was not directed to the Caucasus, it was directed against Stalingrad. So instead

of playing this strength against weakness game, they denied their own philosophy and went strength against strength. People use Stalingrad as the basis for saying blitz, schmitz, or words to that effect. I challenge that. They went against their own philosophy there. Then if we go to North Africa of 1942, of course many of you people have read some of these things that have come out, plus the fact that the British greatly outnumbered Rommel and he did very well except they just finally drove him right into the ground. They would go through reading his mail in some cases before he did and they were able to cut the lines of communication and things that he depended upon in order to be effective. In spite of it, though, he was very successful. Russia in December of 1943, this is the famous Battle of Kursk, the tank battle, at least up to that time the largest tank battle in the world. Interestingly, we find that when the Germans attacked the Kursk salient, depending upon whose accounts you believe, they had between 750,000 and 900,000 troops. The Russians somewhere on the order of between 1.3 and 1.5 million. So now we find that instead of going strength against weakness they were going weakness against strength, so they violated their principles even more.

Of course, that brings in some comments: Why did that happen? How did that come about? We will give you a couple of reasons. One, if you go back to Poland in 1939, we find that Hitler really did not get down to the operational or tactical level. He gave them pretty much what he wanted to do and they carried it out according to the way they thought best. So they had a lot of freedom. When he went into France initially the German army did not want to invade France. The general staff wanted to take a defensive posture. Hitler insisted. Kept putting the pressure on and Manstein delivered his plan. Hitler started undermining the structure. As a result we find that the so-called decentralized

control became more and more centralized. You see orders and instructions given from on high down to lower level units. Not enough so as to lose the battle, but we begin to see it. In Russia, Hitler interfered more and more with that so-called freedom of the lower level commander. We see hardening of the arteries of the blitz system. They denied their own success. Of course, in our bureaucies we do not do that. Ardennes in 1944-1945 was initially very successful. This brings in another notion of Hitler's tremendously centralized control which at least in

some sense permitted it to happen but then he imp sed them down to lower levels. For example, you had the 6th Panzer Army up in the northern sector commanded by Sepp Dietrich in the southern sector you have the 5th Panzer Army commanded by Manteuffel was having some success where in earlier years they did that kind of thing. As a matter of fact if you look back in accounts by Guderian and others, they would make bridgeheads across rivers or streams that were difficult and if they got stopped they would pull out over night and ram that bridgehead somewhere so that they could have that strength against weakness. The Allies did not really show that kind of flexibility. We would stay there and just pound it out bridgehead by bridgehead. The Germans would pull out, and go somewhere else and then go forward. Not unusual. In the Ardennes it was recognized that the Schwerpunkt had to be shifted from the northern to southern sector. It was not done. So they just wasted away their people. Even so, we never did cut it off. With all our troops, all our artillery. They backed out.

Guerrilla campaigns or guerrilla results. I do not want to spend too much time on it except to bring out the point that here, I have a British friend here too, we fought the British in 1775. They were the Redcoats. We were the guerrillas. You go all the way through the same thing. We find out we behaved like the Redcoats and fought the guerrillas here in the Ardennes.

SLIDES ON "PATTERNS OF CONFLICT"

COLONEL JOHN BOYD

WARP XII

PATTERNS OF CONFLICT

2 February 1978
20 March 78
18 May 78

John R. Boyd

OUTLINE

0 BACKGROUND

• HISTORICAL INVESTIGATION

• SYNTHESIS

PURPOSE

- To discern a Pattern for Successful Operations
- To help generalize Tactics and Strategy
- To find a basis for Grand Strategy

BACKGROUND

AIR-to-AIR

GENERALIZATION

- Need fighter that can both lose energy and gain energy more quickly while outturning an adversary.
- Suggests a fighter with a higher aerodynamic G and higher turn rate/lower turn radii for positive energy rates -- but not necessarily higher turn rates/lower turn radii for negative energy rates.
- In other words, suggests a fighter that can be used to pick and choose engagement opportunities -- yet has a fast transient ("natural hook") that can be used to either force an overshoot by an attacker or stay inside a hard turning defender.

IDEA EXPANSION

- Idea of fast transients suggests that, in order to win, we should operate at a faster tempo than our adversaries -- or better yet, get inside adversary's Observation-Decision-Action time scales.
- Why? Such activity will make us appear ambiguous (unpredictable) thereby generate confusion and disorder among our adversaries -- since our adversaries can only perceive an opponent's image that does not match the real (fast transient) opponent they are competing against.

EXAMPLES

- Blitzkrieg vs Maginot Line Mentality (1940)
- F-86 vs MiG-15 (1951 - 53)
- Israeli Raid (1976)

NEW CONCEPTION

● ACTION: Exploit operations and weapons that:

- Generate a rapidly changing environment (quick/clear observations and decisions, fast tempo, fast transient maneuvers, quick kill),
- Inhibit an adversary's capacity to adapt to such an environment (cloud or distort his observations and decisions)

● GOAL:

Collapse adversary's system into confusion and disorder by causing him to over and under react to activity that appears ambiguous, chaotic or misleading.

A-to-A and A-to-G

RECIPE FOR GENERATING CONFUSION AND DISORDER

- Observations
 - Quick/Clear Scanning Sensors
 - Suppressed/distorted signatures
- Activity
 - Quick and precise performance
 - High Speed (supercruise)
 - Rapid energy gain and rapid energy loss coupled with hi turn rates and lo turn radii
 - Hi pitch rates/Hi roll rates/Hi yaw rates coupled with ease of control
- Kill Mechanism
 - Quick shoot fire control systems and high speed weapons

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GOAL

- Improve our capacity for independent action

This may mean we need to

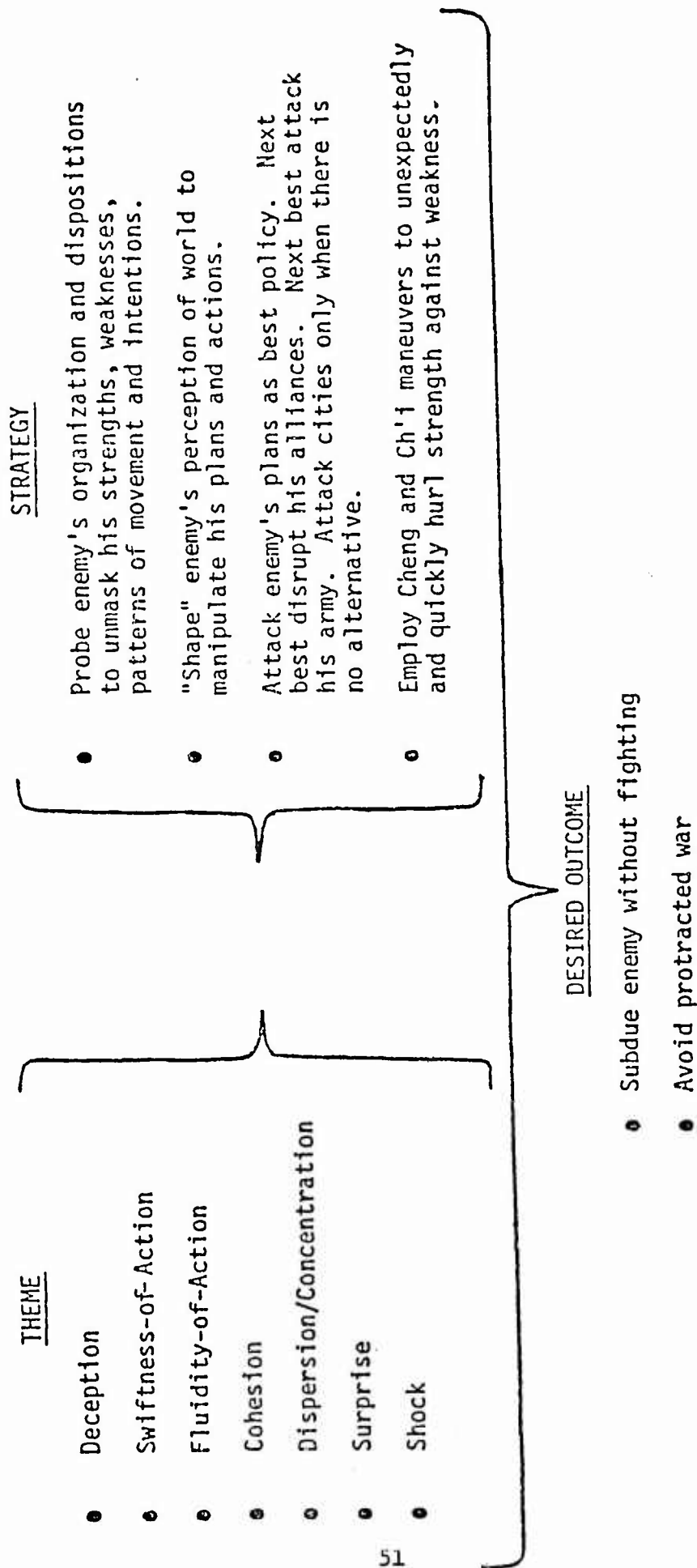
- Deprive our adversary of his capacity for independent action.

QUESTIONS

- How do we realize such a goal by waging war?
- Does history give any insight or suggest any useful pattern?

HISTORICAL PATTERN

SUN T'ZU -- "THE ART OF WAR" -- AROUND 400 BC



HISTORICAL PATTERN

Early Commanders

- Alexander
- Hannibal
- Belisarius
- Genghis Khan
- Tamerlane

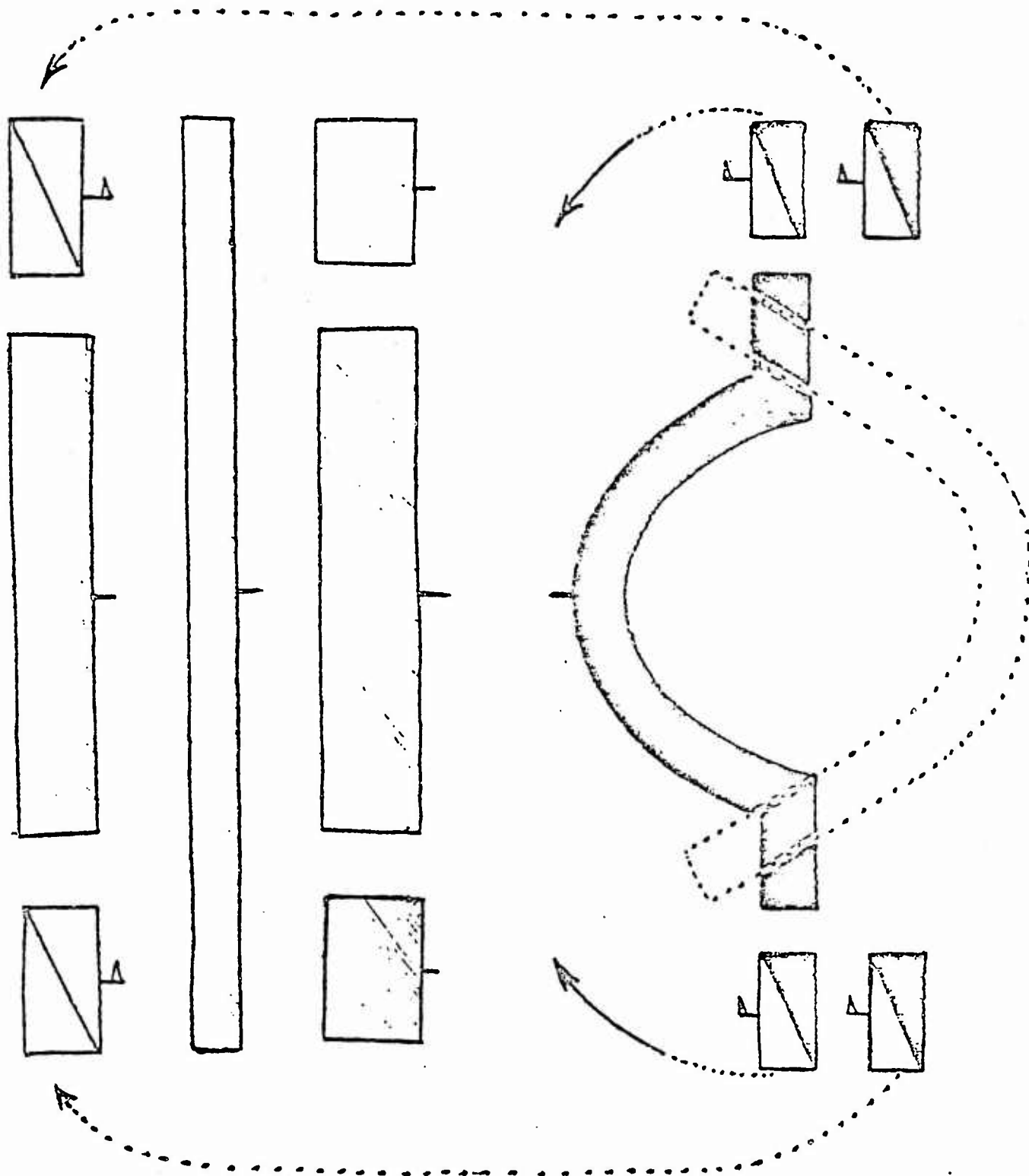
Impression

- Early Commanders seem consistent with ideas of Sun Tzu
- Western Commanders more directly concerned with winning the battle
- Eastern Commanders closer to Sun Tzu in attempting to shatter adversary prior to battle

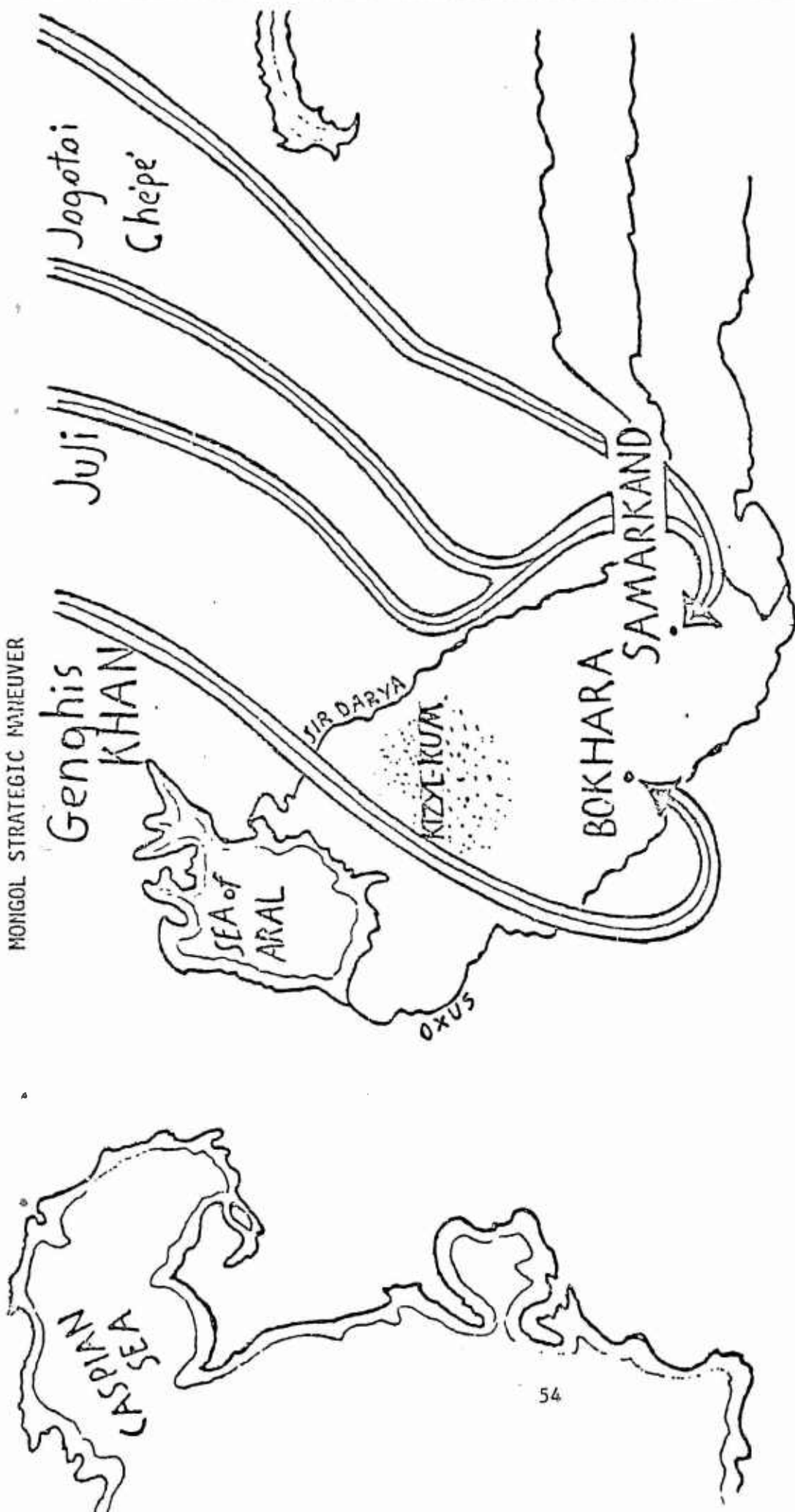
Action

Cheng and Ch'i

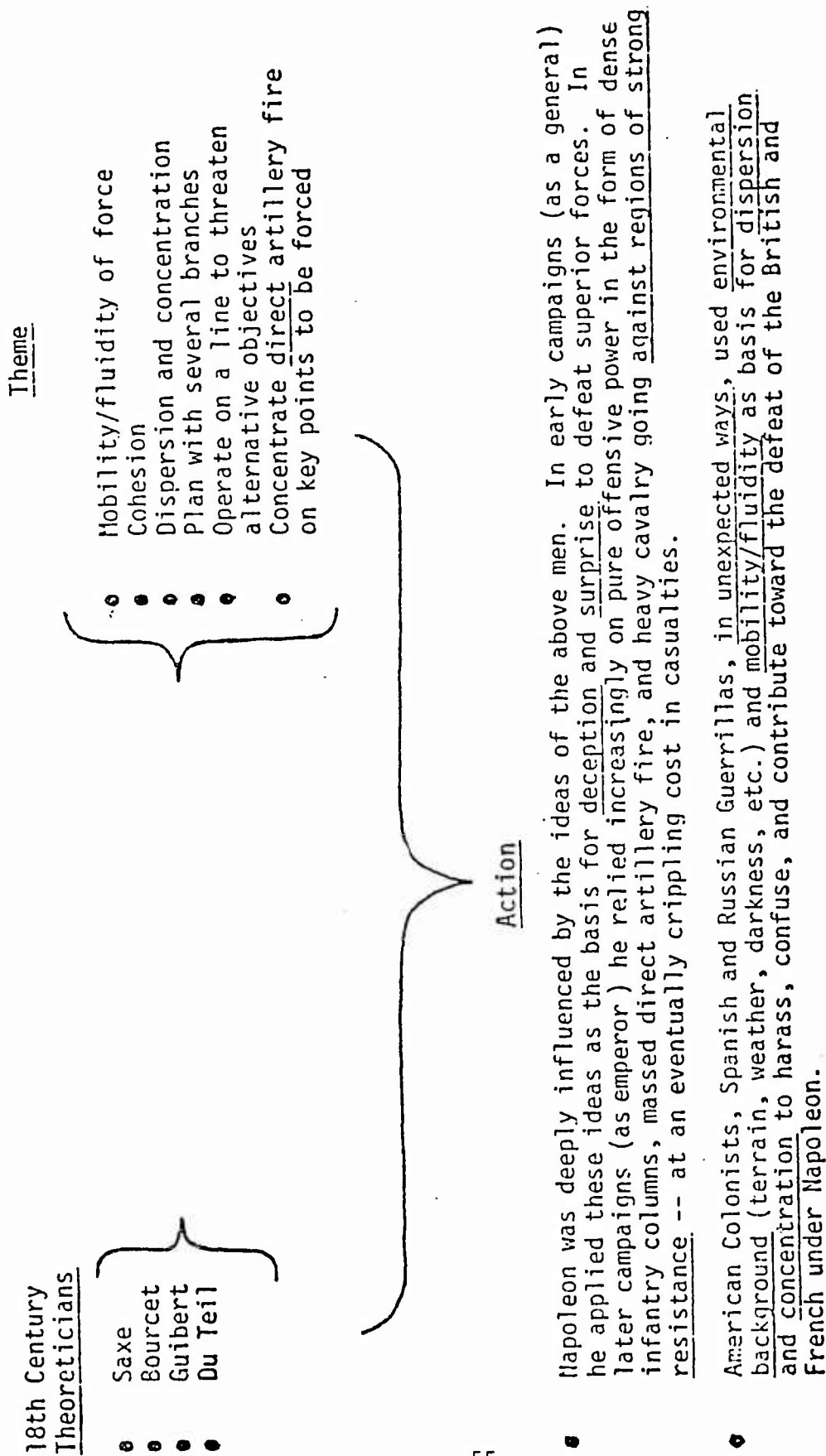
BATTLE OF CANNAE



MONGOL STRATEGIC MANEUVER



HISTORICAL PATTERN



IMPRESSION

The ideas of Sun Tzu, Saxe, Bourcet, and Guibert seem to be at home with either Regular or Guerrilla Warfare.

HISTORICAL PATTERN

KARL VON CLAUSEWITZ -- "ON WAR" -- 1832

Overemphasis

Decisive Battle

Underemphasis

Strategic Maneuver

Why?

Clausewitz was concerned with trying to overcome friction/uncertainty and failed to address the idea of magnifying adversary friction/uncertainty.

HISTORICAL PATTERN

19th Century Technology

- Railroad/Telegraph
- Quick Fire Artillery
- Machine Gun
- Repeating Rifle
- Barbed Wire
- Trenches

Early Trends

- Emphasized massed firepower and rail logistics to support it
- Increased emphasis on a holding defense and flanking maneuvers on a broad front to gain a decision
- Use of frontal assaults by infantry supported by artillery barrages against regions of strong resistance

Result

- Huge armies, and massed firepower and other vast needs supported through a narrow fixed logistics network suppressed deception, surprise and mobility of any operation.

KEY POINTS

The massing of enormous supplies through a narrow logistics network -- coupled with the influence of a Clausewitzian battle philosophy -- "telegraphed" any punch hence minimized the possibility of deception, surprise and mobility to gain a decisive edge.

In this sense, technology was being used as a crude club that generated frightful and debilitating casualties on all sides during the:

American Civil War
Austro-Prussian War
Franco-Prussian War
Boer War
Russo-Japanese War
World War I

(1861-65)
(1866)
(1870)
(1899-1902)
(1904-05)
(1914-18)

WORLD WAR I

● PLANS AND EXECUTION

● STAGNATION

● FINALE

WORLD WAR I

Action

- Offensives conducted on wide fronts
- Evenness of advance maintained to protect flanks and provide artillery support as advance makes headway
- Reserves thrown in whenever attack held up -- against regions or points of strong resistance

Reaction

- Defense organized into depth of successive belts of fortified terrain
- Massed artillery and machinegun fire designed to arrest and pin down attacker
- Counter-attack to win back lost ground

Result

- Stagnation and enormous attrition since advances made generally as expected along paths of hardened resistance because of dependence upon railroads and choice of tactics of trying to reduce strong points by massed infantry and firepower.

WORLD WAR I

A WAY OUT

Idea

• Infiltration Tactics

• Guerrilla Tactics

Authors

- Capt Laffargue
- Gen Von Hutier?
- Gen Ludendorff

- T.E. Lawrence
- Paul Von Lettow-Vorbeck

WORLD WAR I

Infiltration Tactics

Action

- Brief but intense artillery bombardment to disrupt/suppress defenses and obscure the assault.
- Assault by constantly reinforced special teams (stormtroopers) trained for cohesion and equipped with grenades, light machine guns, and light mortars with orders to avoid opposition and pour (infiltrate) into any gaps they could find or create.
- Follow-up teams of infantry, machine gunners, mortars, field engineers and artillery observers move-in to mop-up isolated centers of resistance.
- Reserves are fed through gaps from the rear to enlarge gaps and breaches along paths of least resistance and consolidate gains against counter-attack.
- In this way reserves are employed to support success instead of trying to redeem failure against regions of heavy resistance.

Idea

- Achieve a tactical breakthrough in order to gain the opportunity to apply the strongest form of attack: envelopment.

WORLD WAR I

Infiltration Tactics

- Result
 - Immediate success at platoon/company/battalion level coupled with ultimate failure at corps/army level.
- Why?
 - Ludendorff violated his own concept by his tendency to use strategic reserves to reinforce against hardened resistance -- hence at the strategic level, he seduced himself into supporting failure not success.
 - Exhaustion of combat teams leading the assault.
 - Logistics too inflexible to support rapid/fluid penetration and deeper exploitation of breakthrough.
 - Communications too immobile to allow command to quickly identify and reinforce successful advances.
 - Elastic Defense (when used) as developed by the Germans and practiced by Petain.

WORLD WAR I

Guerrilla Warfare (a la T. E. Lawrence)

Action

- Gain support of population. Must "arrange the minds" of friend, foe and neutral alike. Must "get inside their minds".
- Must "be an idea or thing invulnerable, without front or back, drifting about like a gas" (intonspiciousness and fluidity-of-action). Must be an "attack-in-depth".
- Tactics "should be tip-and-run, not pushes but strokes" with "use of the smallest force in the quickest time at the farthest place".
- Should be a war of detachment (avoiding contact and presenting a threat everywhere) using mobility/fluidity-of-action and environmental background (vast unknown desert) as basis for "never affording a target" and "never on the defensive except by accident and in error".

Idea

- Disintegrate existing regime's ability to govern.

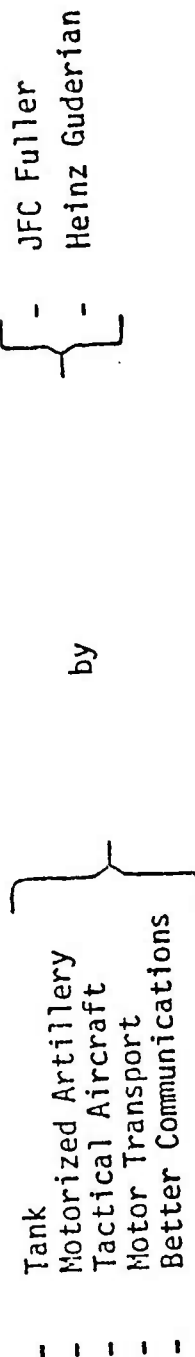
IMPRESSION

- Infiltration tactics a la Ludendorff seem to be similar in nature to Irregular or Guerrilla tactics a la Lawrence.
- Why? Both use fluidity-of-action and cohesion of small units to concentrate strength against weakness -- but at different levels of concentration.

MAJOR ADVANCES BETWEEN WORLD WAR I AND II

LIGHTNING WAR (BLITZKRIEG)

- Infiltration Tactics of 1918 were mated with:



- Result:
 - Blitzkrieg to generate a breakthrough by piercing a region about 1-2 kilometers wide at two or more points on a narrow front with armor, motorized infantry, and follow-up infantry divisions supported by tactical aircraft.

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GUERRILLA WAR

- Guerrilla Strategy and Tactics were codified by Mao Tse-Tung.
- Result:
 - Modern Guerrilla Warfare has become an overall political, economic, psychological and military framework for "total war".

BLITZKRIEG AND GUERRILLA STRATEGY

Infiltration

- Blitz and guerrillas infiltrate a nation or regime at all levels to soften and shatter the moral fiber of the political, economic and social structure. To carry out this program, a la Sun Tzu, Blitz and Guerrillas:
- Probe and test adversary to unmask strengths, weaknesses, maneuvers, and intentions.
- Shape adversary's perception of the world to manipulate or undermine his plans and actions.

Purpose

- To force capitulation when combined with external political, economic, and military pressures.
- or
- To minimize the resistance of a weakened foe for the military blows that will follow.

WORLD WAR II
Blitzkrieg

Action

- Intelligence, reconnaissance (air and ground), and patrol actions probe and test adversary before and during combat operations to uncover strengths, weaknesses, moves, and intentions.
- Schwerpunkt (point of main effort) established before and shifted during combat operations to bypass adversary strength and strike at weakness. Nebenpunkte (points of other effort) employed to tie-up or drain-away adversary strength.
- Indirect and direct air firepower efforts together with (any needed) sudden/brief preliminary artillery fires are concentrated in sharply defined areas of main effort to impede (or channel) adversary movement, disrupt communications, suppress forward defensive fires, and obscure the advance.
- Armored reconnaissance or stormtrooper teams, leading armored columns, advance rapidly from least expected regions and infiltrate adversary front to find paths of least resistance.
- Armored assault teams of tanks, infantry, combat engineers, anti-tank/assault guns, and other specialists, together with close artillery and air support, quickly open breaches and gaps along paths of least resistance uncovered by armored reconnaissance or stormtroopers.
- When breakthrough occurs, relatively independent mobile/armored teams led by armored reconce, with air support (reconce, fire, and airlift when necessary), blow-through to penetrate at high speed deep into adversary's rear along paths of least resistance. Object is to cut lines of communication, disrupt movement, paralyze command and envelop adversary forces and resources.
- Motorized or foot infantry further back supported by artillery and armor pour-in to wipe-out isolated pockets of resistance, enlarge the breaches and secure the encirclement or captured terrain against possible counter-attack.

Idea

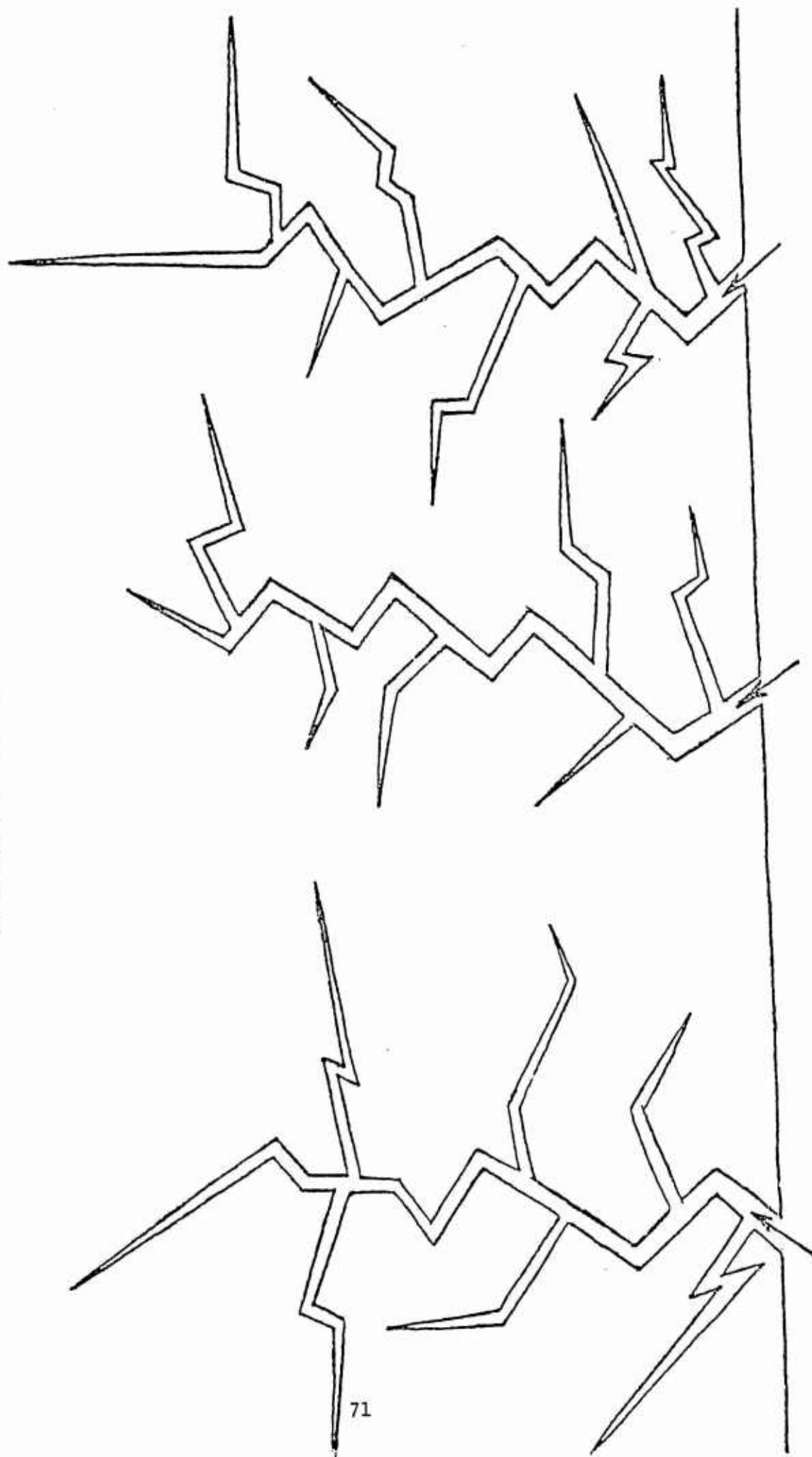
- Conquer an entire region in the quickest possible time by using initial surprise coupled with fast tempo/fluidity-of-action and cohesion of armored teams, with air support, as basis for quick concentration and shifting of attack and follow-on echelons against an adversary's communication, command, and support structure in order to confuse, disorder, and finally shatter his will or capacity to resist.

UNIFYING CONCEPT OF BLITZKRIEG

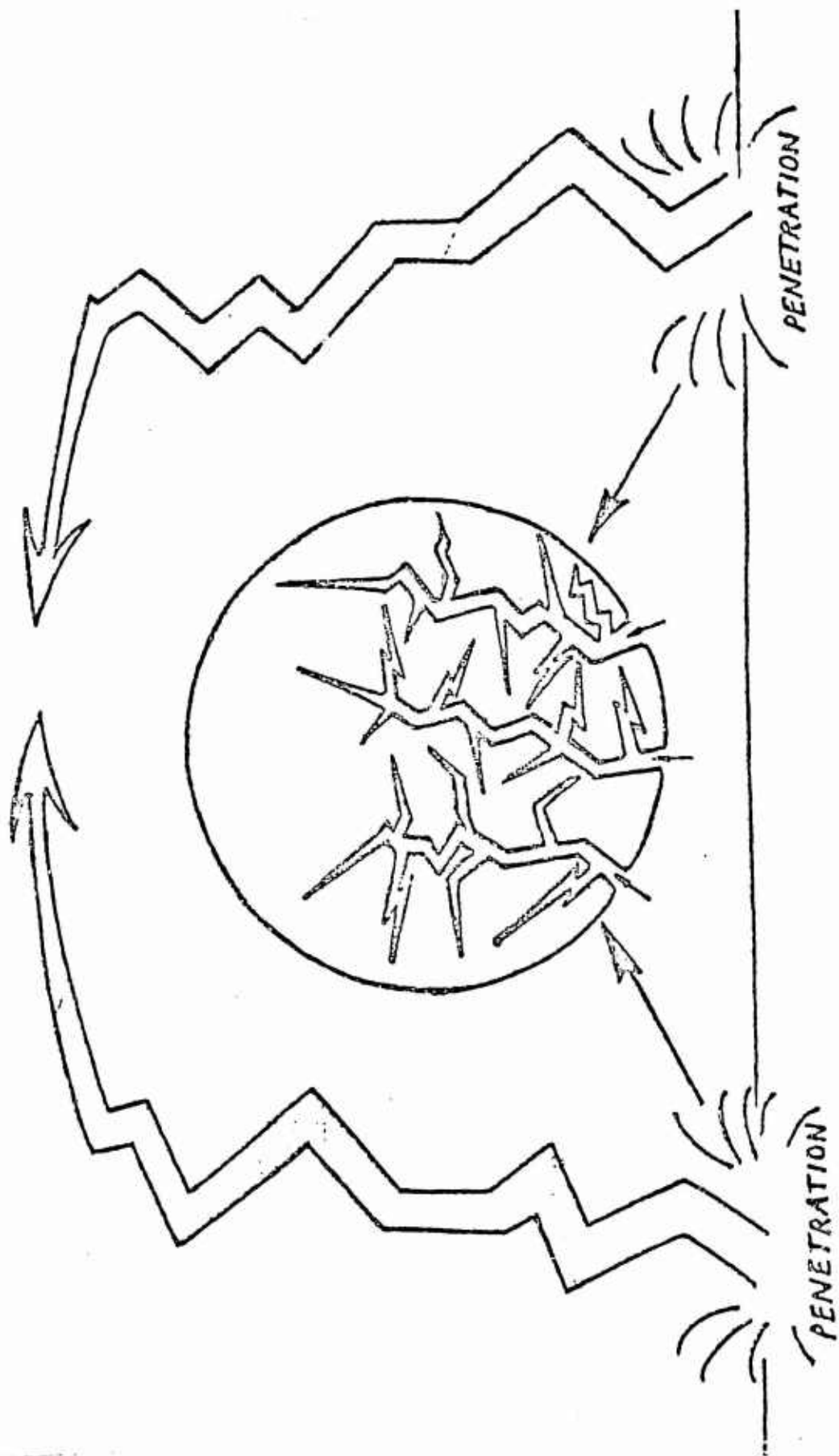
Schwerpunkt (Point of Main Effort)

- Implies a dramatic thinning out of force and effort in other sectors as basis to generate local superiority.
- Applies at all levels from platoon to theater.
- Center or axis around which:
 - Maneuver (fire and movement) of all arms and supporting elements are focused to exploit opportunities and maintain tempo of operations.
 - Initiative at tactical level is meshed with intent at strategic level.
- Unifying concept that provides a way to focus effort, harmonize (as well as focus) support activities with combat operations and permit a true decentralization of tactical command within centralized strategic guidance -- without losing cohesion of overall effort.

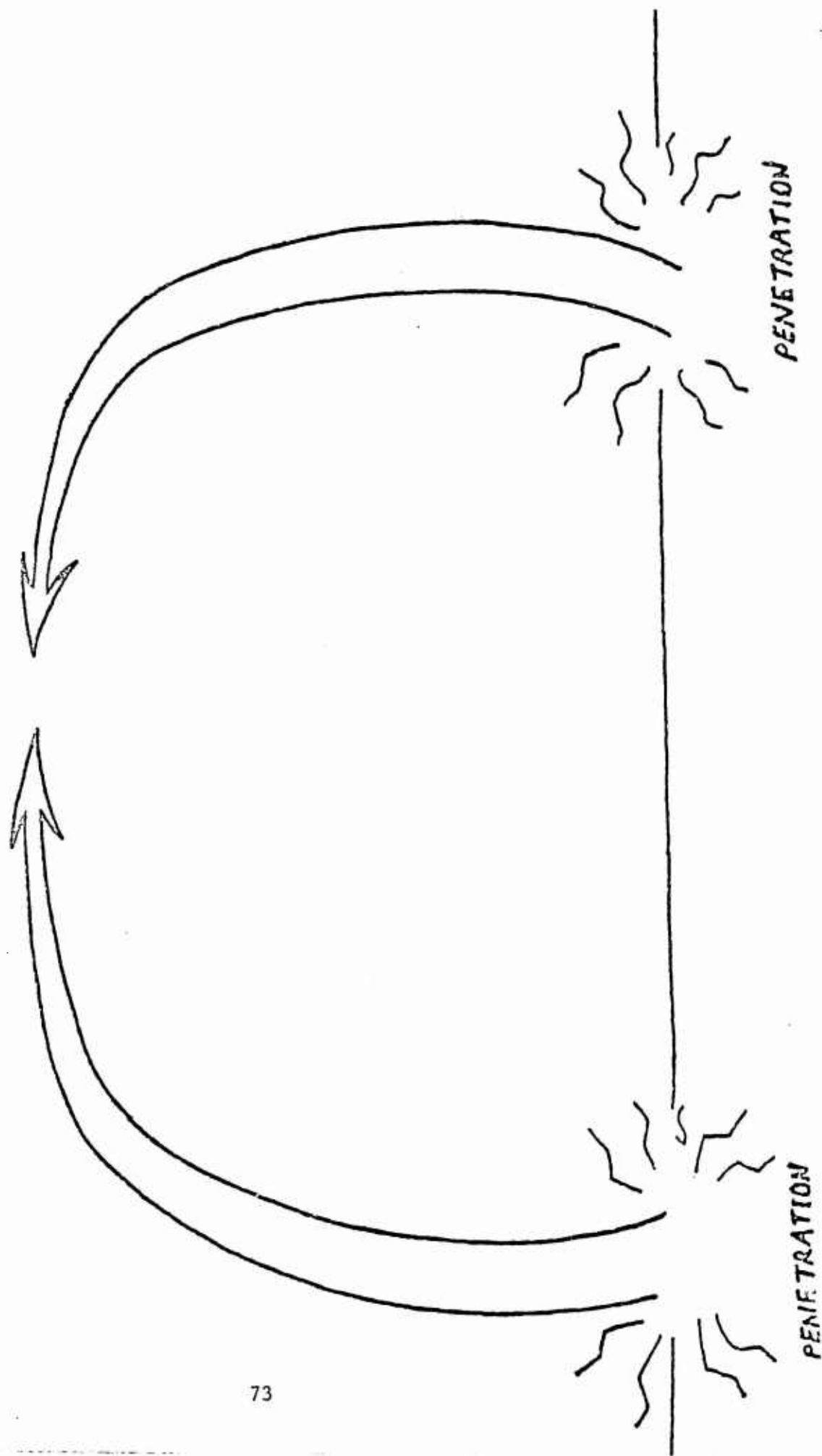
IMPRESSION OF THE BLITZKRIEG PENETRATION



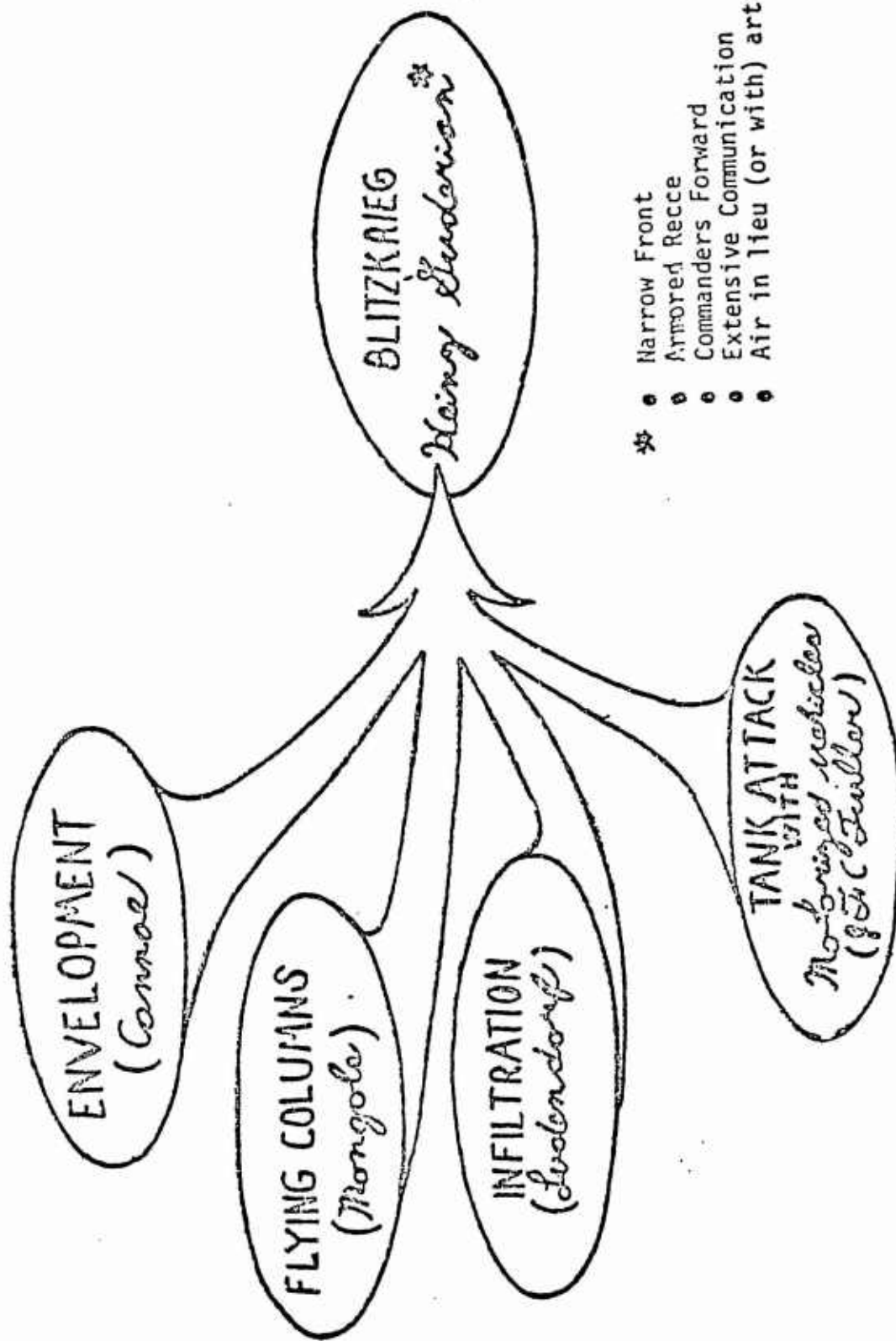
*Impression of the Liner
(Envelopment)*



*Typical Impression
of
Blitzkrieg Envelopment*



Creation of the Blitzkrieg



WORLD WAR II

Blitzkrieg

Key to Success

- Use of Schwerpunkt concept to focus, shift, and harmonize operations and support at all levels.
- Intelligence, reconnaissance (air and ground) and stratagem emphasized before and during combat operations to unmask and shape patterns of adversary strengths, weaknesses, moves, and intentions.
- Initial surprise coupled with fast tempo/fluidity-of-action and cohesion of armored teams, with air support, to permit repeated and rapidly shifting concentration of strength against weakness thereby generate doubt and uncertainty which magnify into panic and chaos.
- Decentralized command -- based on "schwerpunkt" -- with wide freedom for lower level combat leaders (forward) to exploit opportunities generated by rapid action within a broad loosely woven scheme laid down from central command.
- Superior mobile communications to maintain cohesion of overall effort and to enable higher command levels to allocate reserves and support and to shift point of main effort.
- Essential and only essential logistics tail (using airlift when appropriate and necessary) to support high speed movement and rapid shift among routes of advance.

MODERN GUERRILLA CAMPAIGN

Action

- Capitalize on corruption (real or imagined), incompetence and unwanted presence of existing regime to organize and maintain mass popular support through a militant political program.
- Set-up administrative and military organization, sanctuary and communications network under the control of the guerrilla political leadership without arousing regime's intelligence and security apparatus.
- Probe and test, by infiltration of regime political/military organization, to uncover strengths, weaknesses and intentions.
- Disrupt the political/economic/social structure by fomenting civil disorders (such as rallies, demonstrations, strikes and riots), by selected terrorism and by the use of sabotage to demonstrate and magnify (by propaganda) the presence of corruption and the inability of regime to govern.
- Employ tiny cohesive bands for surprise hit-and-run raids against lines of communications to gain arms and supplies as well as disrupt government communication, coordination, and movement. Retreat and melt into environment when faced by superior police and armed forces.
- Employ methods to expand guerrilla influence/control over inhabitants and countryside as basis to gain more recruits, expand base areas and erode government influence. (e.g., encourage government to indiscriminantly take harsh anti-population reprisal measures, magnify grievances of population and play upon their obsessions by propaganda and "re-education". ...)
- Harass ever larger government concentrations (in front, flank, and rear) with ever larger bands by sudden ambush against supply columns and patrols and by infiltration or sneak attack against isolated detachments. Disperse to avoid open combat or a major assault by superior forces.
- Demonstrate disintegration of regime by carefully selected attack against major force units using methods of conventional warfare.

Idea

- Defeat existing regime by politically challenging the right and ability to govern and militarily by continuously using stealth/fast tempo/fluidity-of-action and cohesion of small bands as basis for concentration, dispersion and shifting of forces to harass, confuse and ultimately destroy his will or capacity to resist.

MODERN GUERRILLA CAMPAIGN

KEY TO SUCCESS

- Ability to continuously demonstrate government weakness, erode government influence, and alienate government from population.
- Environmental background and use of stealth/fast tempo/fluidity-of-action coupled with cohesion of tiny bands as basis for repeated concentration against weakness, dispersion to avoid adversary strength and shifting of effort to keep initiative.
- Support of population (both psychological and physical) that willingly furnishes recruits, intelligence, transportation, shelter, refuge, food, money and medical aid.
- Sanctuary (or base) as safe area to which guerrillas "can retire voluntarily or involuntarily, for rest, recuperation, repair of arms, clothing, and " equipment, and where recruits can be indoctrinated, trained and equipped."

BLITZ/GUERRILLA THEME

Essence

- Initial surprise and shock followed by surprise and shock again, again, again, ...
- Avoid battles -- Instead disrupt connections, centers, and activities that provide cohesion (communications, lines of communication, command and supply centers, ...).
- Roll-up the isolated units/remnants created by the surprise, shock and disruption.

Intent

- Shatter cohesion, produce paralysis and bring about adversary collapse -- by generating confusion, disorder and panic.

DISRUPT THE CONNECTIONS AND CENTERS THAT PROVIDE COHESION

Israeli example (a la Gen. Y. Yadin - 1949)

"To exploit the principles of war for our purpose and base ourselves upon strategic indirect approach, so as to determine the issue of the fighting even before fighting has begun, it is necessary to achieve the three following aims:

- (a) to cut the enemy's lines of communications, thus paralysing his physical build-up;
- (b) to seal him off from his lines of retreat thus undermining the enemy's will and destroying his morale;
- (c) to hit his centers of administration and disrupt his communications thus severing the link between his brain and limbs."

BLITZ RESULTS

<u>Successful</u>		<u>Unsuccessful</u>	
•	Poland	•	Russia
	1939		Winter 1941-42
•	France	•	Russia
	1940		Fall, Winter 1942-43
•	Balkans	•	North Africa
	1941		1942
•	Russia	•	Russia
	1941		Summer 1943
•	North Africa	•	Ardennes
	1941-42		Winter 1944-45
•	Russia		
	Summer 1942		
•	Russia		
	Feb-March 1943		
•	Advance Thru France		
	1944		
•	Manchuria		
	1945		
•	Middle East		
	1967		
•	Middle East		
	1973		

GUERRILLA RESULTS

Successful

- American Colonies 1775-81
- Spain 1808-14
- Russia 1812
- German East Africa 1914-18
- Arabia 1916-18
- China 1927-49
- Russia 1941-45
- Yugoslavia 1941-45
- Indochina 1945-54
- Algeria 1954-62
- Cuba 1956-59
- South Vietnam 1958-75

Unsuccessful

- Philippines 1899-1902
- South Africa 1900-02
- Greece 1944-49
- Philippines* 1946-54
- Malaya* 1948-60

* Regime exercised particular care not to inflict casualties and to protect population.

? KEY QUESTION ?

- Why have Blitz and Guerrilla tactics been so extraordinarily successful?

FUNDAMENTAL MESSAGE

Action

- Blitz and Guerrillas repeatedly and unexpectedly hurl strength against weakness by being able to move and shift more quickly and to concentrate or disperse more quickly from or to lower levels of distinction (organizational and environmental) without losing cohesion of overall effort.
- Put another way, Blitz and Guerrillas "get inside adversary's" Observation-Decision-Action or Mind-Time-Space framework.

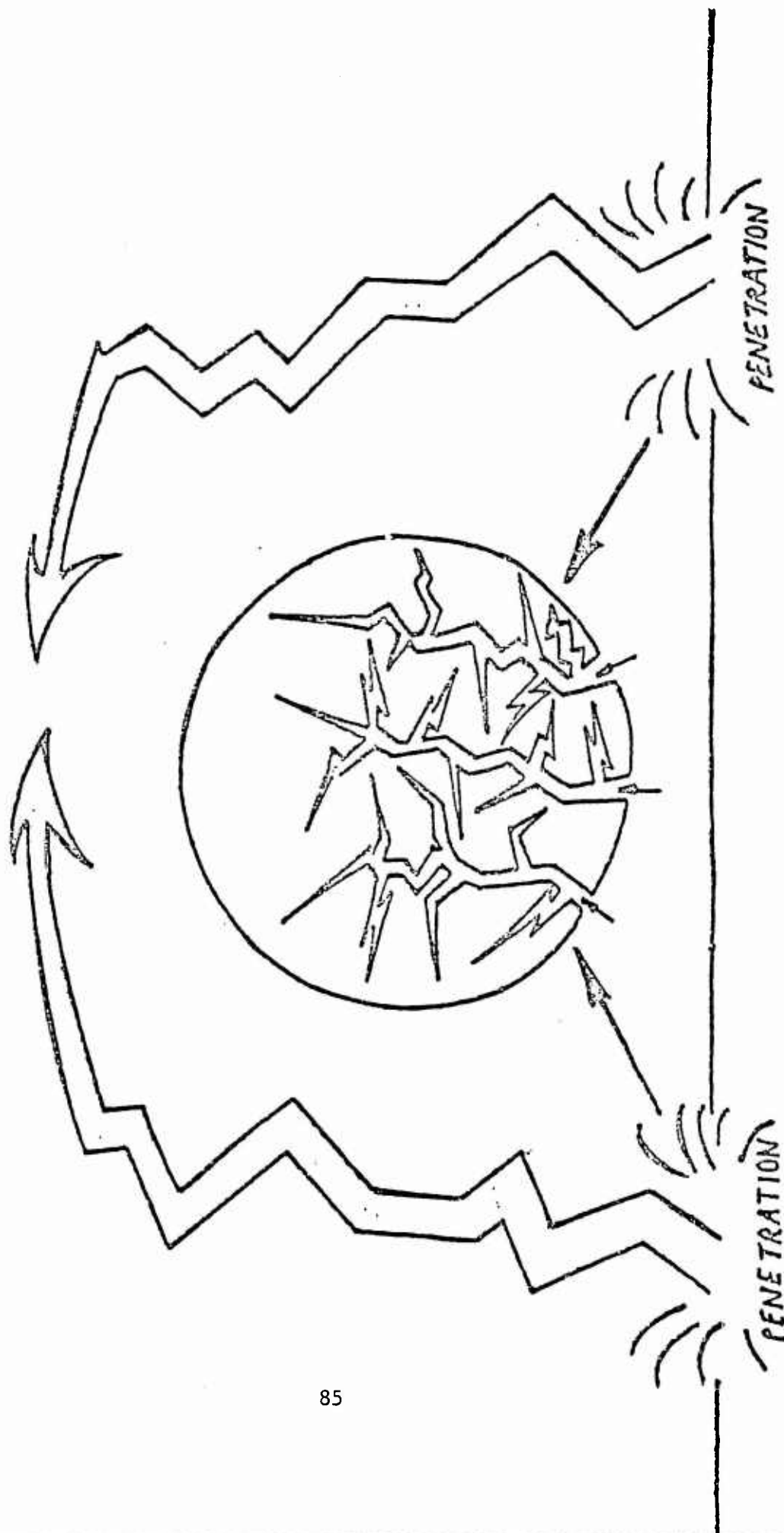
Result

- Such activity by Blitz and Guerrillas make them appear ambiguous (unpredictable) and awesome which magnifies into confusion, disorder and panic (among their adversaries) to shatter cohesion, produce paralysis and bring about collapse -- a notion implied by Sun Tzu around 400 BC and more recently recognized by J.F.C. Fuller after observing the impact of Ludendorff's infiltration tactics in 1918.

NATURAL QUESTIONS?

- How can we defend against or counter the Blitz?
- How can we defend against or counter the Guerrilla Movement?

22 Where are the Weaknesses
of the Policy? 44



KEY POINT

Difficult to sustain fast tempo and maintain cohesion of Blitz effort when forced to repeatedly and rapidly shift concentration of strength against weakness.

COUNTER-BLITZ

(Variation of German Experiences During WWII)

Posture

- Emphasize intelligence, reconnaissance (air and ground) and set-up screen of forward outposts and patrols to report on adversary activity and warn of any impending or actual incursions.
- Deploy and disperse reconnaissance and mobile anti-tank infantry/armored teams together with artillery in region behind screen so that they can inconspicuously/quickly move laterally and forward to focus and shift local main efforts against adversary thrust(s).
- Place armored teams, as mobile reserve, in echelon behind recce, anti-tank infantry/armored and artillery so that they can easily focus effort, and quickly move-in to decapitate any local breakthrough -- or push-off for a Blitz counterstroke.

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Action

- Employ air and fast moving mobile/armored reconnaissance teams to determine direction/strength of thrust(s) and to continuously harass by repeated delaying actions and hit-and-run attacks in order to slow momentum and erode cohesion of Blitz attack.
- Inconspicuously move-in with high speed mobile anti-tank infantry/armored teams, together with air and artillery support, to stiffen favorable defense positions and combine the ambush with repeated sudden/sharp (but short) flank counter-attacks to channel as well as drain-away momentum and break-up cohesion of Blitz thrust(s).
- Concentrate swift armored combat forces (held in reserve) and use with air to rapidly drive a shallow and/or deep flank counterstroke in order to envelop and roll-up Blitz offensive in detail (counterstroke launched while adversary is moving forward).

Idea

- Smash Blitz offensive by inconspicuously using fast tempo/fluidity-of-action and cohesion of counter-Blitz combat teams as basis for shifting of forces and quick concentration of air and ground effort to throttle momentum, shatter cohesion, and envelop Blitz in order to destroy adversary's capacity to resist.

NOTE

Counter-Blitz imposes a greater stress than Blitz upon the cohesion of friendly combat teams -- since Counter-Blitzers must be able to react more inconspicuously and quicker than Blitz counterparts.

WHERE IS THE WEAKNESS OF GUERRILLA EFFORT?

Guerrillas need cause and support of population that is dependent upon regime's corruption and incompetence.

COUNTER-GUERRILLA CAMPAIGN
(a la Mikhail Tukhachevsky and Ramon Magsaysay)

Action

- Undermine guerrilla cause and destroy their cohesion by demonstrating integrity and competence of government to represent and serve needs of people -- rather than exploit and impoverish them for the benefit of a greedy elite.*
- Take political initiative to root out and visibly punish corruption. Select new leaders with recognized competence as well as popular appeal. Ensure that they deliver justice, eliminate grievances and connect government with grass roots.*
- Infiltrate guerrilla movement as well as employ population for intelligence about guerrilla plans, operations and organization.
- Deploy administrative talent, police, and roving counter-guerrilla teams into affected regions to inhibit guerrilla communication, coordination and movement as well as minimize their contact with local inhabitants.
- Take and keep initiative by relentless pursuit. Employ (guerrillas' own) tactics of reconnaissance, infiltration, surprise hit-and-run, and sudden ambush to keep roving bands off-balance and to make base areas untenable.
- Emphasize capture and conversion to government cause -- instead of harsh anti-population reprisal measures and "body count" -- as basis to undermine guerrilla influence.
- Visibly identify central government with local political/economic/social reform in order to connect government with hopes and needs of people, thereby gain their support and confirm government legitimacy.

Idea

- Destroy guerrilla cohesion and break their hold upon the population via political initiative that demonstrates moral legitimacy and vitality of government and by relentless military operations that emphasize stealth/fast tempo/fluidity-of-action and cohesion of overall effort.

* If you cannot realize such a political program, you might consider changing sides!

CURRENT EXAMPLE

Recognition of Problem

Excerpt from Parade Magazine (8 May 77)

...No more ostentatious displays of wealth in South Korea -- that's the latest word from President Park Chung Hee.

Park is a noted champion of capitalism, but he is wise enough to know that vulgar displays of wealth emphasize the tremendous gap between the rich and poor of his country and thereby breed resentment.

He has therefore issued an order banning the wealthy from building large residences. Those who already occupy such mansions will move into more modest buildings.

Also in effect are orders banning extravagant parties, funerals, weddings, and anniversary celebrations. "These affairs stimulate resentment," Park declares, "and hinder the promotion of national unity between all classes of people."

Dictator Park, a peasant's son, apparently was shocked by the ostentatious display of wealth when he recently toured Dongbingo, a wealthy suburb of Seoul. He saw private homes equipped with swimming pools, elevators, saunas, and the latest electronic gadgetry.

SYNTHESIS

PATTERN FOR SUCCESSFUL OPERATIONS

•	Goal
•	Plan
•	Action
•	Support
•	Command

PATTERN FOR SUCCESSFUL OPERATIONS

Goal

- Deprive adversary of his capacity for independent action.

Plan

- Probe and test adversary to unmask strengths, weaknesses, maneuvers, and intentions.

- Shape ambiguous posture with many branches } to manipulate or undermine adversary's plans and actions.

- Shape adversary's perception of the world

- Select initiative (or response) that is least expected.

- Establish focus of main effort together with other (related) effort and pursue direction that permits many branches and threatens alternative objectives.

- Move along paths of least resistance (to reinforce success).

- Disrupt adversary's connections, centers, and activities that provide cohesion and permit coherent observation - orientation - decision - action.

Action

Observe, orient, decide, and act more inconspicuously, more quickly, and with more fluidity, without losing cohesion of overall effort, as basis to repeatedly and unexpectedly focus main effort against weakness, apply other effort to tie-up or drain-away adversary strength, and shift these efforts to keep or gain initiative.

Support

- Superior mobile communications } to maintain cohesion of overall effort and sustain appropriate pace of operations within available resources.
- Only essential logistics

Command

- Decentralize, in a tactical sense, to encourage lower level commanders to shape, direct, and take the sudden/sharp actions necessary to quickly exploit opportunities as they present themselves.

- Centralize, in a strategic sense, to formulate policy, sketch flexible plans, allocate resources, and shift focus of overall effort.

IMPRESSIONS

- Plan and Action statements suggest that we are trying to:

- Run-up the number of environmental states
- Shape arrangement of states
- Fabricate focus of these states
- Compress time

- Intentions that make-up Plan cannot happen without application of transients that make-up Action.

FIRST IMPRESSION

A synthesis of these Plan and Action statements suggests a rediscovery of the 18th Century or Napoleonic notion of Grand Tactics -- "tactical velocity mated with strategic deception".

or as we shall put it:

Magnify the number, shape the arrangement, and fabricate the focus of environmental states (real and imagined, clear and obscure) that an adversary must consider, then reshape arrangement, shift focus and compress the time within which an adversary must react, or adapt, to cope with these transient states.

SECOND IMPRESSION

Transients

Observe, Orient, Decide
and Act more inconspicuously,
more quickly, and with more
fluidity...

or put another way

Get inside adversary's
Observation-Orientation-Decision-Action
or Mind-Time-Space

Permits
one to

Intentions

Probe and test adversary to unmask strengths, weaknesses, maneuvers, and intentions

Manipulate or undermine adversary's plans and actions by

-- shaping ambiguous posture with many branches

-- shaping his perception of the world

Select initiative (or response) that is least expected

Establish focus of main effort together with other (related) effort and pursue direction that permits many branches and threatens alternative objectives

Move along paths of least resistance (to reinforce success)

Disrupt adversary's connections, centers and activities that provide cohesion and permit coherent observation-orientation-decision-action

Focus main effort against weakness, apply other effort to tie-up or drain-away adversary strength and shift these efforts to keep or gain initiative

Generate uncertainty, confusion, disorder, panic, chaos,... to shatter cohesion, produce paralysis and bring about collapse

Become an extraordinary commander

NOW ALTOGETHER

Strategy

- Shatter cohesion, produce paralysis, and bring about adversary collapse by generating uncertainty, confusion, disorder, panic chaos...

Grand Tactics

- Magnify the number, shape the arrangement, and fabricate the focus of environmental states (real and imagined, clear and obscure) that an adversary must consider, then reshape arrangement, shift focus and compress the time within which an adversary must react, or adapt, to cope with these transient states.

Tactics

- Observe, orient, decide, and act more inconspicuously, more quickly, and with more fluidity, without losing cohesion of overall effort, as basis to repeatedly and unexpectedly focus main effort against weakness, apply other effort to tie-up or drain-away adversary strength, and shift these efforts to keep or gain initiative.

or put another way

- Observe, Orient, Decide, and Act inside adversary's Mind-Time-Space framework.

A SENSIBLE GRAND STRATEGY

- Should support national goal.
- End conflict on favorable terms.
- Ensure that conflict and peace terms do not provide seeds for (unfavorable) future conflict.

GRAND STRATEGY

Essence

- Shape pursuit of national goal so that potential adversaries realize some benefits and are empathetic toward our success.

Basis

- An appreciation for our underlying self-interests and our potential adversaries' obsessions.

PATTERN

National Goal

- Improve our capacity for independent action

Grand Strategy

- Shape pursuit of national goal so that potential adversaries realize some benefits and are empathetic toward our success

Strategic Aim

- Deprive adversary of his capacity for independent action

Strategy

- Shatter cohesion, produce paralysis, and bring about adversary collapse by generating uncertainty, confusion, disorder, panic, chaos....

Grand Tactics

- Magnify the number, shape the arrangement, and fabricate the focus of environmental states (real and imagined, clear and obscure) that an adversary must consider, then reshape arrangement, shift focus and compress the time within which an adversary must react, or adapt, to cope with these transient states.

Tactics

- Observe, orient, decide, and act more inconspicuously, more quickly, and with more fluidity, without losing cohesion of overall effort, as basis to repeatedly and unexpectedly focus main effort against weakness, apply other effort to tie-up or drain-away adversary strength, and shift these efforts to keep or gain initiative.

or put another way

- Observe, orient, decide and act inside adversary's mind-time-space.

NOTE

On one hand, the National Goal and Grand Strategy as expressed appear to be in disharmony with the Strategic Aim, Strategy, Grand Tactics, and Tactics notions that make-up the pattern. On the other hand, application of these latter four strategic and tactical notions permit real leadership to avoid high attrition, avoid widespread destruction, and gain a quick victory. This combined with shattered cohesion, paralysis, and rapid collapse demonstrated by the existing adversary regime make it appear corrupt, incompetent, and unfit to govern. Under these circumstances, leaders and statesmen offering generous terms can form the basis for a viable peace. In this sense, the first two and the latter four notions can be in harmony with one another.

Message

Need a force that is superior to any potential adversary in terms of:

- Inconspicuousness
- Quickness
- Fluidity
- Cohesion

Question

Does the present or planned force possess these qualities?

NATURE OF THE EUROPEAN FEBA

HERO

Colonel Bell

May 25, 1978

TAPE No. 4

My name is John Sloan. I am going to just briefly state the parameters of our study and then Ray will go through the actual presentation.

We call this study we are doing "target position assessment" and the purpose of it is to describe and represent the nature of the combat zones in the immediate vicinity of the so-called forward edge of the battle area (FEBA) in modern warfare. Our purpose is to try to provide tactical Air Force commanders and planners and the pilots an improved understanding of what the nature of this area is and the operational circumstances they will face in trying to approach targets. Probably because when people study battles on maps they see all these lines drawn, there has been a tendency to think of the battlefield in terms of two sides. Each side occupies a clearly defined space and these spaces are separated by some kind of neat line. The line might be straight or it might have curves in it, but our study is an attempt to find out if that is in fact so or to show how it differs from a simple conception such as that. To do it we selected nine campaigns, seven from World War II and the other two from the Arab-Israeli wars. We selected the campaigns to show examples of situations. Particularly, we picked ones that were dynamically moving, not just static campaigns where two armies did sit and cross river valleys for weeks or something similar.

We have tried to find the most illustrative examples that will serve our purpose. We have picked ones that could show different levels, the different scales. This is another thing you have to think about when you are talking about this depiction of the forward edge of the battle position, so called, at the battalion level and what it looks like and at the division level, corps, or the theater level. It will be depicted and it will look different. The first one in chronological order we took was the German invasion of France in 1940 which we have described at the army level, but we have actually shown the movements in the German divisions. That is the lowest level which we showed of the front-- what it looks like at division bases. Then we took the German invasion of Russia in 1941. We took that down to the division level also, just showing the invasion

in the Ukraine with one Panzer group. Then we got the Battle of Kursk. I wish we had known exactly what we were going to be doing here today and I would have brought that along too because it shows at the battalion level the 48th Panzer Corp's attack on the south flank at the battle of Kursk. It shows how these fingers of infiltration that were described so aptly actually worked. Perhaps we can talk about that later in the discussion when we have the Soviet defensive in Belorussia where the Third Mechanized Corps actually broke through and the whole Corps was ranging tens of kilometers behind the so-called German front line. Actually, on a German battle map after the third day of that battle, their front line was depicted kind of like this, and this is the big hole. They do not even depict the front line on their battle map. That is even at the theater level now. And so there was a whole corps ranging around. Then we have the Allied breakout at Normandy and Operation Cobra where two U. S. corps broke through. Again we have depicted this at the combat command level and you will see that many U. S. combat commands were quite a way behind. In fact, they were going behind whole German army headquarters. That is how far behind the German lines they were. And then we have the U. S. offensive in the Saarland in 1944--two U. S. divisions and the Ardennes campaign finally where the Germans invaded the Ardennes. Then, finally, we have the Six-Day war in 1967 and the Ramadan war of 1973 along the Suez front, depicted at the battalion/brigade level, and showing this same phenomenon.

This line is only a representation. The reality is much different from it and today we will have an example where I hope you can see what has happened. It turns out, coincidentally, that in this particular campaign this was one of the problems the French faced. As Colonel Boyd pointed out, they were thinking in linear terms and they were conceiving that somehow the point of German advance represented some kind of line and there were frequent occasions where whole French units that found themselves behind this so-called line of further German advance thereupon decided that it was appropriate to surrender. They could have fought their way out if they had been thinking in different terms. Without any further ado, Colonel Bell is an armored officer who has served in Vietnam, but not in this kind of combat in armor, what he will depict here is the German invasion of France.

Colonel Bell:

Thank you John. This is going to be kind of a tie-in between what Colonel Boyd had to say and our host. What I am going to describe to you in a little detail are the first eight days of the campaign of the Germans versus the French in 1940. You see on the slide here of battle area that on the 10th of May and on the 20th of May the Germans were on the Coast about 180 miles and the dotted line that you see there is the extent of the position that I am going to discuss today. So I will come back to it.

Briefly, about the terrain--the Meuse River, which is towards the center,--represents for the purpose of discussion today a boundary, to your right or to the east is the Ardennes area. It is fairly rolling terrain. I think it is probably best described as that kind of terrain which, if you wanted to defend it, could be relatively easily defended. It had a relatively good road network; before 1940 most of the important roads were macadamized because of the tourist trade. The Meuse River is a major obstacle. It is a trench. Those of you who have been there to cross have seen that the slopes are very steep along most of the river. To the west of the Meuse River is pretty much a flat plain to the coast. You must also understand that the weather in May was very good--just a little background.

This presentation involves the 7th Panzer Division of the German army. They were grouped into three corps. They were the spearhead, as Colonel Boyd brought out. They operated in teams, reconnaissance conducted by motor cyclists, used armored cars and motorized infantry, and they had tanks. They had different organizations because of the different types of divisions based upon how they were organized after the Polish campaign. The terrain, particularly near Ardennes, is similar to what we might find in the Fulda Gap--my recollection of having cycled through the Ardennes and having spent three years in Germany on the Fulda Gap--it is relatively easy to move through. You have the same type of villages, you have the same type of tree cover, and this type of thing.

It has been brought out that the French were thinking linear tactics and the Germans were thinking exploitation of their mechanization capability. For that reason the road network is particularly important. This is the first time, Poland excepted, that we see the fluid, mobile attack of the Germans beating a linear defense. I am only going to consider the armored divisions. There are different divisions following. The infantry divisions in at least one case pass one of the German armored divisions, but essentially I am zeroing in on the German

armored formations. Again, I cannot emphasize enough that this is a very fluid situation.

The battle positions that are shown on the maps on the charts are very much exaggerated because it is extremely difficult to show on a large-scale map the front line trace or a general positioning of units that are moving very fast, so you have to consider that the width of the lines means nothing. The scale of the map--north is on the top--is 1:500,000. The units depicted here are generally the type of symbols that we use. There is one exception that I think you should be aware of, and that is what we use for a train symbol, i.e., logistical elements, I have used as a motorized infantry organization. You will see some French and you will see some Germans. The solid lines indicate a relatively high density of German troops and it may indicate high-intensity combat--it may. Again, the situation changes from man to man. The dashed lines, although we call them connectors, indicate a very low density of German troops, no troops at all, control action with little contact, artillery. A very nebulous type of situation. Now you will also note that our maps here are relatively busy and that is because we prepared the maps for a study which we did not originally think that we were going to have to depict visually. So you will see groups of little names and that is because in our manuscript they are referred to point blank, point blank.

At 5:30 a.m. German time, the 10th of May, the Germans attack. I am going to highlight the situation that you see depicted here, the 7th Panzer Division led by Rommel initially ran into a considerable number of obstacles which were undefended. In three hours he went six kilometers and then he started to pick up momentum and moved over the very good road network in Belgium to a position which is about 20 miles inside the border. Now this line is where he was at 2400 hours on the 10th of May. Following this division, was the 5th Panzer Division which was always behind the 7th and at one time, a couple of days later, the elite 35th Panzer Regiment was attached to Rommel's division and they helped spearhead the advance in that particular area. It is difficult to say whether this is a Schwerpunkt; it may be a Nebenpunkt. But obviously Rommel, whom I am sure you are all familiar with, was with the troops, bored with the troops, kicking ass, and was not satisfied with people languishing along the way. His motorcyclists were the ones that led the way at this particular time and he followed

up as quickly as he could. The Germans had a great amount of difficulty moving through the Ardennes because there just were not enough roads to accommodate all of the armored vehicles that were trying to move. He had a problem here because if the French ever had gotten their air force together they would have had a field day. The Germans were always looking to the sky to see what was going to happen, and the French never came. Well, they seldom came but when they did they were not able to do too much damage. The 1st Panzer Division moved through Luxembourg, 40 miles in the first day, then met its first resistance crossing the Belgian border. Again, undefended obstacles. They went around them. They got around them and once they got around them the engineers went up and blew them and they moved on relatively quickly. The 10th Panzer Division ran into the French initially down here and then advanced in this direction so that they were approximately here at 2400 hours.

You see a line there. Part of it is dashes and part of it is solid. The width of the line has absolutely no significance. It is very difficult to trace the forward elements, but remember that the Germans were trying to move as fast as they possibly could, therefore they used the roads. If you were looking for German armored columns, then you looked pretty much to the roads. They were opposed by French cavalry divisions which were part mechanized and part horse--quite ineffective. I would like to call this the day when they are building their momentum, and on the 11th of May they are picking up their momentum. You see down here at the bottom of that corner a very busy chart. That is because this is where the battle of Sedan took place, which turns out to be the schwerpunkt. However, on the second day, advancing as they are, again we see the 7th Panzer Division moving forward. They had their armored cars forward now. The French cavalry was up. There were examples of isolated combat, but still nothing really worth speaking of. The 1st Panzer Division here, incidentally, was the forward element down here, and had run into the French 5th Cavalry Division--part mechanized and part horse, as I said before. The Germans gained such momentum, however, that they literally started to overrun the combat and support elements of the French divisions. It means to me, and I am sure to you, that the artillery units were now starting to get into it.

The French were being lackadaisical as they moved forward. They were not sure whether this was really a war. They were convinced, of course, that they had the best army in the world and they were soon to see that they were

mistaken. What little French resistance there was, however, did delay the German timetable by about a day. So this is the third day of the operation. It is the day when the German formation is close on the Meuse River. Again on the north we have Rommel's division, now in the vicinity of Dinant. They closed up there and as soon as they got to the river they started looking for ways of getting across. Combat engineers forward, motorcyclists force, tanks forward, the tanks to provide covering fire for engineer attempts to get across the river. No smoke was available, so Rommel burned houses. He made his own smoke screen. He also had part of the 5th Panzer Division with his 31st Panzer Regiment. They got across the Meuse at night using rubber dinghies and a small dam as part of the way of getting across, or a means of getting across. But the 6th Panzer Division--which we have not seen before because it was having a lot of problems up through the Ardennes, as was the 8th Panzer Division, arrived at the Meuse River at the town of Monthermé. It did not make a serious attempt to cross at night. Now, Rommel, a very aggressive leader, was the one that decided to fire the houses. The commander down here was, as you will see on the next slide, opposed by the 42nd Brigade of the 174th French Division which was composed of Vietnamese, and they fought like hell for two days. Actually it took about three days to get across the river. The 1st Panzer Division and the 10th Panzer Division were there on the 12th, the third day.

Now I have talked about the Germans getting across the river. They did not get the tanks across the river in the 7th Panzer Division area until this day, and they were able to get just a very few across. The problem they had there was that although the French collapsed very rapidly, there were several examples of very stiff resistance and the limited artillery they had and the pillboxes situated down the river raised havoc on the river boats which kept sinking and they could not force the bridgehead far enough forward on the 13th of May to get the tanks across. The 6th Panzer Division was in the process now of trying to get across. It did have a problem, though, because it was bombed by Stukas of their Luftwaffe. The 1st Panzer was also "Stuka'd". I only bring this point up to show that it is not very easy to identify a vehicle from the air, which I am sure is nothing new to anybody else, but it also demonstrates the fluidity of the situation. The advance was so rapid that it was very difficult to tell exactly where the friendly troops were. Down in the south now we have three Panzer division the 1st, 2nd, and the 10th. They started to make motions by heading across the river and the motorized rifle division, the rifle

regiment, was actually the first to get a toehold on the west bank. The 1st Rifle Regiment of the 1st Panzer Division also got a toehold, but again it was a combination of infantry, assault engineers preceded by the Stuka attack, artillery, and then followed up by armored formation moving across the river, with armored formations also providing direct fire support. The French initially put up a very stiff resistance and then the French second line the 55th Division literally collapsed. Now we start to see the disintegration of the French army because they were just not used to handling this kind of assault situation.

Okay, whereas on this day the German's had gotten a toehold, on the 14th they got a foothold. You notice what was happening up here in the north. Rommel did give up and he crossed the river at Dinant, and started to push. I want to point out one French organization which is about ready to appear upon the field of battle and that is the French 1st Armored Division. It was an armored division that had about 160 tanks, four battalions, two battalions of B-1's and two battalions of H-35's, which are supposed to be B-1's, which was very fine French tank and very heavily armored and had a good gun on it, but was relatively slow. The 1st Armored Division was to move forward to reduce the bridgehead. Rommel was engaged with the 4th North African Division, the 18th Infantry Division, and the 5th Motorized Division. He was engaged with parts of it because the French were not a coherent grouping here. They are in fact, very much discombobulated. As a result Rommel was able to consolidate his bridgehead relatively easily. The Vietnamese down here at Monthermé were fighting very well. Notice that no progress had been made by the 6th Panzer Division. They were still down there on the Meuse River, with just a toe hold. The Vietnamese of course were beginning to run out of ammunition. The 1st Panzer Division south with the 10th Panzer Division had now widened the bridgehead south here at Sedan. Your guess is as good as mine. Where was the schwerpunkt going to be? I do not think that the Germans at this particular time were saying "It's going to be here" or "It's going to be there", but they had a pretty good indication as to where it could possibly be. I think you will agree that this is where the schwerpunkt developed.

The 2nd and 6th Panzer--the Vietnamese collapsed, not because they did not fight hard but because of the fact that this thing that Colonel Boyd was talking about has finally taken place. Again, what you are seeing here is not a fixed line. Notice there are a lot of dashed lines. This is the way the situation developed on the 16th, seven days after the initial movement. Here is the Meuse

River. Here is where the forward French formations were. The 1st Armored Division was wiped out. The 3rd Armored Division, the French Armored Division, was down in Sedan with infantry. They are fighting as much among themselves as much as against the Germans. And here we are on the 17th. Again a day where they were closing up on what could be an obstacle but which turned out to be just a brief halt. Hitler halted his Panzer Divisions at this particular time because he thought that the tanks were outstripping the infantry units and he was afraid, lo and behold, that the French were going to get behind them and cut off his tanks. Okay, in summary, this dotted line here, this dashed line shows us where they were on the 17th. Again a very fluid map, and in eight days the Germans had gone 110 miles, in three days more they were at the coast. Thank you very much.

MODERATOR: I would like Colonel John Boyd and Colonel Bell, if you would, to stay up here at this table. If Colonel John Boyd and Mr. Sprey will come forward and answer questions until 5:00, which is our schedule, then we will go ahead and let those that people who have other commitments attend to them and the rest of us will be able to converse on a one-to-one basis up in the reception room. Can I have somebody else open with the questions?

Questions: There was a reference made to the tanks traveling by road. I wonder if you could give us your views how important the roads are or what are the hazards of traveling off the roads? I think you each have something to say.

Answer: One, you have got to understand that they came out of the Ardennes, and I am talking about the French thing in 1940. They pretty well had to go by the roads because there were only limited roads to go through there. In fact, when Manstein laid out his plan he called Guderian in to be sure that the armor would have sufficient roads so that they could push forward with the force that he felt was necessary in order to get the decision in France. Now, in that context, they were pretty much committed to the road. That does not mean they did not have reconnaissance patrols out to the flank and that kind of stuff, but their main units they were pretty much committed to the roads in the Ardennes because of the nature of the terrain. That is why the French did not think that the main attack would come out of the Ardennes. They thought it was impassable. The point that I want to make is that from the Ardennes to the Meuse there was what the Germans regarded as the approach march and not a big combat phase. It was essentially

an approach march through the Ardennes, and the action for the most part did not really start to take on a more serious nature until they hit Sedan and some of the points along the Meuse there.

One of the other things is that it is very difficult, as the speaker pointed out there in one of his thoughts on the dotted and the dashed lines, the major schwerpunkt was out of the Ardennes there. That was the major schwerpunkt. They had this so-called minor schwerpunkt and points of other effort coming out of the north there to suck the allies up into a sort of a sheepling plan. But you have to understand that you have schwerpunkts at every level. Whether you are talking about platoon, company, battalion and regiment and so in a sense when you look at a chart like this--I should have brought out where I have this thing zigging and zagging through--you can think of the cells going through. There is not just a continuous assault of people going down those zig zags. They are like cells just marching their way through, and you have to look at it from an organic viewpoint. Now after that, of course, the major schwerpunkt was intended to come out of the Sedan and it did come out of there. It turned out though that Rommel made much better progress in the 7th Panzer Division than I think they anticipated, but after Guderian got going he was stopped. I do not know if you people realize it, but in France there, I think it was on the 17th, when he was given the order to stop he raised all kinds of hell because he was sort of an insubordinate sort of a general and suggested that they should go on. He got a 24-hour reprieve. What he did not know at the time was that Hitler had put the stop order on. Well, after he got the 24-hour reprieve he wanted to go on and Kleist would not let him and he just finally said I resign. Here in the middle of the drive going across France and he resigned. He called a reconnaissance in force on the 17th.

Well, now what happened was when Von List came in and he was stopped and he had submitted his resignation by radio, Von Brunstedt was very disturbed at his outstanding Panzer commander's resigning in the middle of the drive so he sent List down there to rectify the situation and List apparently was a very good political general. He wanted to get this animosity between Kleist and Guderian rectified so he told Guderian he could proceed with the reconnaissance in force and he said the order still stands and he could proceed with reconnaissance in force and then neglected to find with reconnaissance in force what to convey

to him that it was to do. Guderian then picked up all those three divisions and moved out again. But instead of calling back for a radio, he strung wire so that when he was with his support elements calls were going back to his previous headquarters but since he was not allowed to move the headquarters they thought he was still in a certain position when he was actually moving on. Those sort of things happen. What I am trying to say is it was not all that well-disciplined. The main effort, or the main schwerpunkt, was to come out of that southern sector and evidently it did because Guderian started hustling along his three divisions. The 19th Panzer Corps it was called.

Question: Mr. Connolly, how about on the road, off the road. What were your views?

Answer: Just basically that you make good time on the roads. You had a hell of a problem when you got off them. Tanks do not function well in cross-country terrain. You bog down. You hit obstacles that are difficult to cross. It breaks you up as far as your pattern is concerned. You move much, much faster and more directly if you can stay on the roads.

Question: Mr. Connolly, during your experiences during World War II, did you ever find yourself . . . (question directed to Mr. Connolly unintelligible) what was the depth and breadth of your formation?

Answer: In a word, as Colonel Boyd expressed it much earlier, confusion describes it most perfectly. Very frequently we encountered the enemy both ahead and behind. The tank configuration was, as Colonel Boyd has expressed it, very, very fluid. It was very difficult to tell where the enemy was and where you were and there was a great deal of mixing.

Question: Would you be willing to theorize, you and Colonel Boyd, on what would the results be if the enemy had an attack aircraft similar to the A-10 with an equivalent caliber gun operating against you?

Answer: Let me give you an oblique answer to that or indirect answer. Let us talk about the Normandy beachhead. I will try to come back to you in a little different way. One of the things that we had as an advantage at Normandy was the fact that we had a lot of fighter bombers in the air and when you read the German accounts it really bothered the hell out of them. They felt that if they could have gotten their act together or got their Panzer divisions to move very well they might have had the opportunity to either throw us out of there or pinch us off, whatever the case may be. But if you will recall we had them out-

numbered about 30 to 1 or more. We had these fighter bombers just working over their units all the time. And they did not have what we call a good anti-tank gun. They might have had 50 caliber machine guns or 20-millimeter cannons, or fire rockets that go every which way, and drop bombs. But even so it caused them so much disarray because even though they did not get the tanks per se, do not forget they were getting a lot of those follow-up vehicles for fuel and that kind of stuff that the tanks had to depend upon. That was cutting down their mobility. The idea was to try to stop the movement and so the point that you see coming out of German accounts very often, is the fact that while they could pretty well in some sense contain a lot of these offenses, if they did not have that tactical error there or if the other guy's tactical error is banging away on them, it was very difficult to launch a Panzer thrust. That does not mean they could not do it. It could have been the cause of all kind of difficulty because they even proved in Russia later on, even though the Russians had some superiority, that they were able to do it because even though they had limited air power in some cases they knew how to concentrate it more at the Schwerpunkt or the point of main effort, to use it more appropriately. They did it right up to the end of the war in some circumstances, not so much against us on the Western front because we had so much of an advantage, but in many cases on the Eastern front they were able to do that.

Question: If, as you said in your talk, Colonel Boyd, we only understand attrition warfare, what has to happen to change that? What makes you think we could turn around an enormous bureaucracy with 30 years of self-education in warfare. Where do you start?

Answer: The question is whether we do it, because we seem to have a mind set against it. I think you have to start right down in the military bringing the officers up, all the way up in the military. You are going to have to do it through your national war colleges, your service schools, and everything. You have to develop the insight. You are going to have to run exercises where you can actually show this is an advantage. You do not want to drop safes on somebody, shoot safes at somebody, or do both which is an attrition warfare.

Question: Relatively speaking, where do the Russians stand? Do you think they fall into the same sort of trap that we have, that they are still fighting World War II?

Answer: Let me answer it this way. They learned a lot from the Germans during World War II, and when you read their documents, you know, they have a lot of this maneuver, this kind of an idea. However, I am being very cautious because how much will they really show of what they are going to do? The other point is that when you read their documents and compare them to German documents you see a very strong similarity except you know of course they have many more tank forces and much more motorization than German did during World War II. I am talking about these so-called thrust points or trying to work intervals and gaps. They use the same words--main effort or axis of main advance. You see this same kind of cognizance of what they want to do. But the problem that seems to come in is how much authority or how much freedom of action are they really willing to turn over to their lower echelon, and there seems to be some suspicion about their willingness to do this. In other words, I am trying to tell you that you want to look at theirs as a blitz because they are on a local axis of advance. The only reason they have more mechanization is they can afford to do that. It probably would be a rigid kind of a blitz compared to the Germans and that kind of thing, but they are talking about fast rates of advance. They might not be able to leak around. They just might try to ram through, then pile on with a second echelon. But it seems that they are going through these very rapid rates of advance so how does that compare against us?

Question: A question for Colonel Boyd. This relates to the last question in terms of how our forces would in fact be employed. Consider the forces or could

Answer: Let me answer it a couple of ways. Item one, let us talk about the thinking aspect, and many of us have heard of it here. You know now we like to talk about whether you want to go attack the first or the second echelon, and of course you talk about first and second echelon when you are talking about the Soviet forces. You know they had a first and second echelon at all levels, so I am interpreting maybe the corps level and the people are talking about the first and second echelon or on up. In any case, many of the ideas that we see today, because of agreement or because of certain ideas between the Army and the Air Force, is the Army is going to be able to hold out any penetration and the Air Force is going to go in and attack the second echelon. Now, if the Army is able to keep the breakthrough from happening, that is not so bad if

you accept that assumption, but let us take it the other way. Let us assume that they do make a breakthrough. They come through some of these narrow corridors if our people are spread and they are able to ram it through. Are we going to let them run around in our backyard and keep attacking the second echelon? Yet, many of the theories that we see today are that we are going to go for the second echelon. What you are saying is that there will be no breakthrough, and some people say the Army is going to hold them out, there will not be any breakthrough. In view of the historical evidence, I think that is a very dangerous thing to say. I think if they do break through you have got to be prepared to hit those leading elements, be prepared to hit some of that first echelon to kind of slow down their efforts.

Question: Can you relate that to the kinds of aircraft that we have in our inventory? What kinds do we need in the inventory and how should we use them?

Answer: Kinds of aircraft? Item one, I think you would have to have a large number of them, a couple of airplanes wondering around the air knocking hell out of them. The point being if you need numbers and you are budget limited, you are going to have to start buying on some different principles. And you need simplicity. The reason you want simplicity is because you want to generate high sortie rates to deal with their mass, so you will have massive numbers of airplanes, play that kind of game. If you do not have large numbers, they are just going to swat you aside just like a fly. And there are some other kinds of airplanes, too, the point being that those airplanes do have to be able not only to take damage, they also must be inconspicuous in terms of IR signature and size. They also should be equipped with a weapon to deal with that kind of a threat. I think the big thing is that you are going to need numbers of airplanes and if you buy F-15's and try to use that, you are not going to have the numbers. Plus the fact if you have an F-15 or some of these other expensive airplanes (I have nothing against the F-15) and started dealing with air to ground, you might find yourself trying to run the other guy out of torpedoes by driving your destroyers in front of him. In other words, the cost benefit may go the other way.

Question: Concerning the line of thought of Mr. Connolly, I know that we had a substantial air superiority when we were on the Western front in Europe, but were you ever on the receiving end of the German air? Did you have any experiences in that regard?

Answer: We had relatively little experience with air attack from either side during the latter part of the war when we were spearheading the drive to the Rhine. Our aircraft were attacking over us, strafing retreating German troops ahead of us, but at that point the supplies with the German army were so sharply and drastically reduced that there was virtually no gasoline, you were seeing horse-drawn vehicles retreating from us. Almost all of the tanks had been abandoned and so that really was not a clear indication. Our experience was that high explosives did not bother tanks a great deal. Certainly they might stop them. They might knock off tracks, but you were not going to kill crews to a large extent with high explosives. The tanks would sustain relatively little damage and at that point, as far as I could tell, there were relatively few planes that could do a great deal of damage to tanks.

COUNTERING A WARSAW PACT BLITZ

Pierre Sprey

There is an airplane that would change that situation and, I think, radically. What we really would need to convert that investment into something that could affect the outcome of a war is a large quantity of airplanes that are effective against the kind of targets that we would see early in the war. We need several thousand such airplanes to really make a difference. I mean the U. S. and the European countries need several thousand such airplanes to really impact the outcome of a war in which the Warsaw Pact would make an all out attempt in Central Europe.

Of course, the first question that might occur to you is what is wrong with doing the job with our latest aircraft, say A-10's and F-16's. I think there are a few things wrong with trying to do the job or trying to buy several thousand of those airplanes. The first is you cannot buy several thousand of them because they are simply too expensive. Even the A-10, which at one time we had hoped would not be very expensive, is up to \$5 million fly-away, probably \$7 million programmed cost. The F-16 is substantially worse than that in cost. It is just not the kind of airplane you are going to buy several thousand of. Second, both aircraft are too big. For instance, the A-10 is about 900 square feet of plane view area. It has been oriented to a reasonable-sized fighter. The World War II Messerschmitt 109 had about 250 square feet of presented area. That was a good-sized fighter--small, relatively small in World War II. So here we are with almost four times that size with the A-10. That is a very significant factor. I will be coming back to that factor again.

Even the F-16, which we thought was a small aircraft a few years ago, is not a small aircraft. It is twice the size of a Messerschmitt. It has about 500 square feet of presented area. It is a large airplane. Of course, I do not need to dwell on what is wrong with airplanes that are very large, but obviously in the tactical environment that we are talking about, it is very, very valuable not to be seen or not to be seen until the last moment.

The A-10 has one other disadvantage, of course, that is associated with its size. It is pretty sluggish. It does not have the kind of performance to get really good evasive maneuvers and, of course, it is a little sluggish in

acceleration and climb-out for evading air defenses. The F-16 cannot be faulted on acceleration. On the other hand, it simply has not got the left-hand envelope performance that you need for a real anti-armor aircraft. Basically, its maneuvering capabilities down around 300 knots or below are just not what is required by the nature of the target. We will get into that a little more. Finally, its greatest deficiency at present: it simply has no weapon that is very effective against tanks or any of the targets associated with tanks. That of course, is the great strength of the A-10--it has a superb weapon very suited to the job and I think that is the thing we can be proudest of in the A-10 program.

Now, let us assume that we could build an airplane of which we could afford several thousand and which was really suited to the job of attacking armor. What would we do with it? I think you can see very clearly from the talk yesterday that there are a number of very exciting roles that airplanes have not played before that are possible.

First of all, this airplane would be very valuable in the weakly held areas, the areas outside the main efforts, outside the shoulders of a well-organized blitz campaign. Very important, and something that no one describes as well as Colonel Rudel, is the matter of visual recce. The single most important kind of recce that air forces can do is simple eyeball reconnaissance by pilots who are in direct contact with tactical commanders. That is a kind of reconnaissance that we have not had for years and probably never had on an organized basis. Rudel describes it very clearly in his book. That might be an interesting thing to ask him about. His contribution in that area may very well have been more valuable than the 500 tanks he killed.

Closely related to the question of patrolling and sweeping areas that are thinly held on the ground is the question of using this kind of airplane, a blitz fighter, to back up and coordinate with armored recce units. There is a possibility of real integration of the role and the tactics of a blitz fighter and armored recce units. Of course, armored recce units are absolutely critical to any kind of mobile warfare.

A very obvious use of this airplane is simply to reinforce the anti-tank capability of the main effort. Keep in mind, however, that in doing that, we are really talking about very carefully timed operations. We are talking

about fast-moving warfare, countering breakthroughs and so on. Just having airplanes scouring the general area of enemy armored columns simply is not good enough. You have to talk about things that are carefully and closely timed and integrated with the ground tactics and the ground efforts.

Then, of course, the airplane, if it was able to do all the previous things, would be a great close-support airplane. I do not need to belabor that point. I think there are two main points that I would like to make out of this and that I think you would like to think about addressing with Colonel Rudel.

The first is that we are not talking about just attacking tanks. We are not even talking about attacking groups of tanks. We are talking about attacking, disrupting, slowing down armored units and that is very different. That means we are talking about tanks, trucks, accompanied by antiaircraft, APC's, and even, depending on the battle situation, we are also talking about attacking dug-in troupes.

Secondly, just from the very sketchy description I have given and probably much more from what you heard yesterday, you can see that there is very little role for independent air operations. In this concept of Blitzkrieg or counter-blitz, independent air operations would have very much less effect than air operations that are closely tied into the ground.

Given that we wanted to proceed with a blitz fighter, what are the effectiveness characteristics that we should really home in on? Well, the first, and very critical, of course, is finding armor units. If we look at what a new blitz fighter can do compared to the A-10 and previous aircraft, the improvement potential available to us now is modest. The reason for that, of course, is that there is only one sensor that can reliably find tanks and that is the eyeball. The best we can do is provide a platform that provides the proper speed and the proper visibility to help that eyeball. We have just been through another go-around of the eternal quest after a night sensor or a bad-weather sensor for tanks. We have just been through the infrared business with the Maverick again and that is only, I would say, about the tenth repetition of the great infrared hope that started late in World War II and was already heavily exploited or explored in Korea, and, of course, without fail, that great hope has proven a disaster every time. Of course, our latest experiments in Europe show that again. So the one area of effectiveness in which you cannot expect great

improvements from the new airplane is, in fact, the area of finding tanks. However, it will critically affect the design of the airplane, as I will get into in a minute.

On the question of destroying and disrupting armored units, I think we can look towards a fair improvement. We have already made a great leap, a tremendous leap, probably the most important single weapons advance in air since World War II, with the 30-millimeter gun. However, I think there is some room left for improvement in several areas, both in the airframe and the gun area.

Thirdly, very important, is the question of response and being able to respond very, very rapidly and fast enough in a tactical situation and to respond with large quantities of airplanes, the several thousand that I am talking about. There we can certainly make major improvements over anything we have.

Finally, in the area of surviving the kind of defenses we will see over the 90 Pact divisions I was talking about, there also I think we have a potential for making very, very large improvements.

Let us address the question of finding armor. As I have said, the only sensor we can rely on to find armor is the eyeball. Radar, of course, is completely out of the question. We discussed IR. And, of course, the radio helps a lot. After all, there are people on the ground who are being overrun by tanks and so on. If you are in a position to use their information and, of course, taking peacetime preparation and training, a little hardware, if you are in a position to use the information of the people on the ground, it certainly adds greatly to the capability from the air.

The second thing that is important is, of course, the performance that is associated with using the eyeball properly and this is another area that I think you need to explore with Rudel. He is very clear on this subject. The first factor you have to deal with is that you are not going to see tanks very far away. You do not see them very far away on the ground, you do not see them very far away from the air. Tanks have a vested interest in not being seen and they do whatever they can towards that end. You cannot count on seeing tanks at much more than a thousand yards and probably (a lot of times) less.

We know what the weather in Europe is like. Although we have been so inundated with weather statistics that we have this impression that 90 percent of the time a randomly chosen man standing in Europe is standing in a fog, that is not exactly true. There are low ceilings a very large percentage of the time

in Europe. Interestingly enough the visibility under those ceilings is quite good most of the time, and we are talking about being able to operate well below a thousand feet, then all of a sudden the visibility situation in Europe is not bad at all. If we can operate at 500 feet and below, we should have visibility in Europe something over three-quarters of the time.

What does operating below a 500-foot ceiling and trying to respond to a target you see at less than a thousand yards add up to? It all adds up to a fact that is going to be the first way to make an airplane ineffective. When you are searching for tanks, you need performance capability down to 150 knots, and I do not mean 150 knots with the airplane on the edge of a stall. I mean an airplane capable of very hefty maneuvers at 150 knots. I am not saying that that is where you will stay, and I think an extended speed range is very important, but I think the first thing you have to be careful of in working on this airplane is to protect the left hand envelope performance which in some of these early developmental studies has been sliding pretty badly.

Of course, if you are going to use the eyeball, obviously you want to be able to see out of the airplane in as much of a full sphere as possible and that implies an airplane with a very, very narrow fuselage to the point of discomfort for the pilot. This is necessary in order to get over-the-side visibility, which is really the critical thing and one in which our airplanes up to now, perhaps barring the F-16, have been relatively poor.

The next point, if you have found tanks and you are not flying too fast to attack them from the position in which you find them, the next point is how are you going to go about "killing" them? I put killing in quotes for the very simple reason that you do not have to melt the tank or return it to the scrap heap. Stopping the tank is very adequate for our purposes. We have done a lot of testing in the last ten years. We have explored, I think, pretty thoroughly the range of options the current technologies have to offer. During the 1960's we looked very carefully at cluster weapons. We developed the Rockeye, which is a cluster weapon that is almost as expensive as a missile, and it proved to have very little effectiveness. Not only did it prove to have low effectiveness, it was also relatively easily countermandable with stand-off screens. As you remember, Rockeye was a little cluster weapon that tried to spread shaped charges over a sizable area. I think our experience in that testing and the calculations we

did convinced us that Rockeye was not going to bail out the basic inaccuracies of dive bombing. We checked all kinds of missiles. We checked several kinds of electrooptical missiles. We have now just gone through a big go-round of IR missiles and laser guided missiles. Basically, our tests in Europe of the Maverick show clearly that you cannot pull the lock on a tank and that you are far too vulnerable in trying to launch a TV missile just because it takes so long to line up and track and lock on. We cannot afford weapons that take 10 to 15 to 20 seconds to get rid of.

So that returns us to the only weapon that showed much promise against tanks in World War II, which was a large-caliber gun. I mentioned we have made tremendous progress with that. The results are very, very impressive. We are now at the point, I will not get into the exact numbers, but we are now at the point where we have a gun that reliably, at over a thousand yards, will give us the total destruction of the tank almost half the time and will give us mobility kill of the tank over three-quarters of the time. That is far and away better than the record of any missile that we have tried so far. In fact, as you know, with the missiles we have tried so far we cannot even get lock-on a quarter of the time, much less kill, and there are many a slip between the lock-on and the kill.

I do not want to belabor the gun point any more than that. It is critical to the design of this airplane, of course. As you may recall, I mentioned that I think there are opportunities for improvement. I think the first and clearest opportunity for improvement is the need to get out more shots in the very opening of the burst. This goes back to an old controversy of some ten years ago about the relative effect of shots early and late in the burst and we can discuss it later if anybody is interested. I am convinced that shots early in the burst, the first quarter of a second, are an order of magnitude more effective than shots fired upon the second. Therefore, we can reflect that kind of knowledge in the design of the gun by getting guns that get up to rate very quickly.

The second area in which we certainly can make improvements is in the question of aircraft handling as it affects gun accuracy. I want to be very clear on what we mean by gun accuracy. We do not mean gun accuracy on marked ranges. We are talking about gun accuracy in a tactical environment. That means in a constantly jinking approach with relatively high g's, certainly more

than two or three g's, and a bare minimum of tracking time, say on the order of one and a half, perhaps at most two seconds of tracking time. Whatever accuracy you can get under those difficult approach conditions, that in my opinion is the real accuracy of the airplane. In that kind of accuracy it is obvious that we can make great improvements over the A-10, largely because of the size of the A-10 and secondly because they did not really try for that in the A-10.

A third area in which we can make an improvement, once we come clear on what weapons work, what weapons do not, and what we are designing this airplane for, if we recognize the fact that this airplane is, strictly speaking, a gun-carrying airplane, then I think it becomes clear that we need a selectable feed. That is, we cannot go out loaded up with nothing but armor-piercing ammunition on a mission where we may encounter things other than tanks. Armor-piercing ammunition will not do much for us if we run into dug-in troops. It will not really address soft targets, like trucks and so on as effectively as he will. I think we need at least the ability to select two kinds of ammo, possibly three. That will be, in essence, the equivalent of an increase in payload.

Further, I think we need not be rigid on sticking with exactly the gun we have. As good as it is, I think we should be quite open towards the possibility of either increasing its caliber, or increasing the velocity of the round, or of changing the configuration of the round, if we see real effectiveness improvements. Since we are already doing live firing against tanks, I think we are in a good position to do that. We are in a good position to get away from the model building approach to tank vulnerability and lethality. We have to look at our live firing results, carry out some new line firings to see whether added penetration or added behind armor spall or any one of the characteristics that we could change in our round would really give us a lot more kill. If it does not, then fine, let us proceed with the round we have.

Anyhow, I think you see that there is quite a bit of potential there for improvement. My guess would be we are talking about lethality improvements perhaps on the order of fifty percent or more per pass, at least at the longer ranges.

The next question in killing armor is how do you get into the position to shoot. The first thing I would like to say is that a subject that we have ignored in the past is the rate at which we kill tanks. Some of you may be aware

that there has been a recent little exercise for the A-10 to see how fast a pair of A-10's could kill ten tanks laid out on the desert. A lot of people when they first hear about that exercise think it is some kind of stunt. If you stop and think about it, it is far from being a stunt. It is addressing, in fact, the heart of the tactical problem that you face once you have found a tank unit. After all, when you have attacked your first tank, they are not all going to sit there like they do on the range. They are going to take counter measures, they are going to disperse, they are going to head for the woods. They will do everything they can to destroy the effectiveness of your attack. In turn, the faster you can reattack and the faster you can wipe out the entire unit, the less time they have to take countermeasures, the more effective you will be, the less likely they are to get into a position in the woods or a barn or something that makes them invisible. This is again the kind of thing that people who have been there can tell you about, and I think Rudel is interesting on this subject. His book mentions it and I think it is something to keep in mind.

Now, what does it take to reattack fast? To reattack fast, it takes a very high level of maneuvering components at moderate speed. In particular, the thing we are interested in, and I think this is in large part an outcome of some of John's work on fast transients in air-to-air fighters, is what we call the button hook turn, which is of real interest and a really critical capability.

By button hook turn we mean a turn at high g and high deceleration. That is, if for one reason or another, you are in a fast cruise speed and you run across a tank, you want to convert as quickly as possible into an attack. That is the first step in getting a high rate of kill. The ability to decelerate very hard while turning into position is extremely useful because, of course, it leads to a turn at rapidly decreasing radius which is exactly what you want instead of having to fly out a couple of miles, reposit and reattack. If you have a real button hook turn capability, you will be able to greatly reduce the separation between you and the tank as you come in for the first attack. And, of course, I think all of you who are involved in aircraft recognize that means low aspect ratio wings.

The time we are talking about is something that can be worked out. There are some programs running in the country that will do optimum reattack profiles and we need to exercise those programs more heavily than we have in the

past. We used them once or twice in the A-10 program and now it is time to get serious about them. I think using those programs we will see that we should be able to get substantially below thirty-five seconds reattack time. I think that will be an important element in trading off the final controlling characteristics of this airplane.

There are two lessons here that I would like to leave you with. One, as I think you now realize from our A-10 experience, including bombs and missiles in payloads of the close support airplane inevitably makes the airplane big and sluggish.

The second point is for the kind of performance we are talking about, the kind of reattack capabilities and the kind of capabilities that I will be talking about later that are necessary for survival, I think we are going to be talking about quite high thrust weights, higher than people have generally talked about in close support aircraft. I think the range we should be looking at is .7 and maybe a 1.0 kilometer. At the same time, we are not interested in just maximum turn capabilities similar to that of the A-10. We would like something better and, in particular, we would like it to be able to decelerate at a very high rate while turning.

Assuming we have found tanks, assuming we have the performance and are in a position to kill them, and have the weapons to kill them effectively, the next question is how to put up enough airplanes to make a difference. In thinking about how many airplanes make a difference, I think there are basically two kinds of missions that we want to keep in mind that in essence define effective force size for us. Obviously, there are vastly more missions than this that the airplane can carry out. But just in looking at what affects force size, we are looking at covering weak sectors, some kind of all-day patrol situation, or it could be covering one of our own ground units against surprise attack as basically done in Patton's advance on France. If we are talking about that kind of situation, the force size that counts is the number of airplanes in the air all day long, and it is very simple to calculate what affects that. The thing that affects that is loiter time. The more loiter time you have the more airplanes you will have on station under the fixed force size. The sortie rate is directly proportional to the effective force in the air and cost is inversely proportional.

The other kind of mission we have is not one where we are trying to maintain a presence over some period of time but where we are trying to meet the need for an attack at a fixed time or over a fixed period of hours or days. In that case, the force that counts is our surge sortie rate or our surge number of sorties delivered to the target times the number of kills that those sorties can deliver. So very clearly what counts there is the surge sortie rate itself, the probability of kill on each burst, and the number of bursts you have on board.

Both these kinds of effective force size have to be addressed and I think you will see very clearly how they relate to the kind of airplane we are talking about. For the kind of simplicity that we have envisioned, obviously the sortie rate will be high, perhaps even higher than with the A-10, although the A-10 is certainly not to be faulted on that score. On cost we hope to make a big improvement over the A-10--that situation is not really satisfactory. In loiter time, of course, the A-10 is not to be faulted. The key thing for us is to see how to get very adequate loiter time without making the airplane big.

Given that we have enough airplanes to make a difference, they still have to be there. They have to be where they are needed and they have to be there on time. As we know from our Vietnam experience, that is easier said than done. In general, our response times in Vietnam, even in close-support and emergency conditions, were pretty poor. They normally averaged on the order of 45 minutes, which is practically an order of magnitude too large for emergency situations on the ground. I think there is some agreement among people with experience in this area, people who have performed real close support and ground tactics, that something on the order of a five-minute response is what is really needed if you are talking about airplanes reinforcing a unit that is suddenly surprised and about to be overrun. The only way you can achieve a five-minute response--there simply is no way other--is to respond by being on station in the air and not too far away, and the only way to get that capability is to have plenty of loiter time. Keep in mind that the kind of loiter times we are talking about here, two hours or more, are not the loiter that is in the basic mission of the airplane, these are additional capabilities with wing-mounted external fuel.

The other critical thing, of course, since we have been talking about new ways of using air and integrating it with blitz or counterblitz operations,

is that we have to be able to move this force and shift it far more rapidly than we are used to shifting air forces. This you might call the strategic mobility or the basic mobility of a blitz fighter force. To really use this airplane and to apply it at the points where it is needed and within the response time of the ground tactics, you need to be able to shift a wing-size base overnight and a squadron-size base a good deal faster than that. That means very light support and stuff that basically can be operated from trucks--the kind of efforts that went into the bare base package perhaps squared.

At the same time, given that we are in generally the right part of the front because of our strategic mobility, or, if you wish, theater mobility, we also need to be able to respond very rapidly from a strip alert, and I guess if it is something like ten minutes, it is desirable. We obviously cannot put all the airplanes up on loiter all the time because it is far too expensive. But we do need to have a very substantial reserve force that can respond to the needs of some reconnaissance outfit that gets cut off or some main unit that is starting to get overrun or whatever. With that reserve force we would be on strip alert and we need roughly ten minutes to respond. That means we really cannot afford to be based much more than forty miles away. That, in turn, means we are going to have to live with a very different kind of base than we have been used to before. Perhaps many of you know we have already made progress in that area with the exercises at Bicycle Lake with the A-10. But we need to go a little further than that.

Now, in this concept of airplane we are talking about an airplane that can be based on a road or on a grass field or on light strips suitable to Cessna- and Piper-type like planes. That, as you will see in a moment, leads to some painful choices on landing gear.

The last question, and one about which there has been a great deal of conceptual discussion, most of which has served to cloud the issue rather than to clarify it, is the question of survival. Naturally, whenever we raise the question of airplanes whose principal weapon is a gun, the technology lobby immediately counters "They'll never survive" and then we get out the usual statistics of the number of SA-6's and the SA-8's and the SA-9's in a Soviet division and all that. I think, in fact, the standard views on the air defense threat over a Soviet division are misinformed to say the least.

If you put yourself in the position of a division commander who has just been told to make twenty miles during daylight, you will begin to see what the problem is. It is simply not possible to move fast with a modern mechanized armored division and carry along the quantities of air defense that our intelligence people say would be associated with divisions. In fact, if you get down into the details and the bean counts, you will see the threats that are quoted are not air defense that is associated with divisions, that it is all army-level air defense. There are no SA-6's that are organic to the divisions. Now, of course, SA-6's could be assigned forward to divisions as could SA-2's for that matter. But with a little more care about the question of the organizational level at which air defenses are located, it is very important to assess this. There is a good reason why SA-6's and other large radar missiles are not assigned to divisions and that is they are basically not supportable by divisions during most operations. Because of the long setup times involved with all radar missiles, even if they are mounted on track chassis, and because of their very large support requirements in terms of people, parts, and logistics, they are really a burden to a division commander and, in fact, will never be seen with a Soviet division that is on the move.

The actual weapons that you will see with a Soviet division that is moving fast towards a breakthrough or after a breakthrough will be surprisingly similar to World War II weapons. That is, you will see all the kinds of guns that can be towed by jeep-size vehicles and trucks or that can be mounted on trucks and you will see the types of missiles that people can carry and set up in a couple of minutes or less, and that means RED EYE type missiles, basically SA-7 or its variance. And that is it. That is all you will see in a tactically engaged, moving Soviet division.

Now, it is very important to contrast that with what you would see in a static situation. If you have a division dug in in a static position, as for instance the Egyptian division on the Suez Canal, then, of course, the nature of the defenses changes totally. Then you have time for the half-day emplacement time or so that most radar missiles take. Then you have time to bring up all the extra ammunition, the very bulky missile ammunition. You have time to bring up the technicians and get everything calibrated and so on. Then, of course, you will encounter very fierce defenses. The gun defenses too will be far fiercer

because they will have better logistics and much higher densities too and that is exactly what the Israelis ran into. Remember the Israelis did not run into any kind of mobile air defense. The high attrition rates that we have all been so worried about that the Israelis encountered were all against static defenses. There is probably a general principle there. I will not go much further, but, in general, it is probably not possible for aircraft to do much in the face of static defenses. It never has been in the past, it probably will not be in the future.

But we are talking here about a very different aircraft in a very different situation. That is important to keep in mind. Given that long preamble, what can we do to really increase the survivability of this airplane over what we have had in the past? First and most important, and this again is a subject on which Rudel is very clear and very helpful, absolutely minimum non-maneuvering time in the presence of guns is critical. The difference in the hit probabilities of guns against straight level airplanes versus maneuvering airplanes is probably on the order of two orders of magnitude. The only reason that we keep on ignoring this kind of thing and the importance of it is, of course, that we have no decent anti-aircraft guns and no anti-aircraft gunners. As a result we do not know some of the simple basics.

The last time Rudel was in this country, I think he really amazed us in telling us when we asked him what his tracking time was with guns. He said it was one and a half seconds, and, of course, most of us are used to thinking about four, five, six, seven seconds tracking time associated with dive bombing. I think our first reaction was that he was exaggerating. But after a lot of questioning on that point and on the tracking times and what average pilots were getting and so on, I came to the conclusion that he was telling the truth and that he, in fact, could execute a hard maneuvering approach basically alternating from one wing, from standing on one wing tip to the other during his approach to a tank, at say thirty to fifty feet altitude, snap out, wings level for one and a half seconds, fire and go off into his maneuvering climb out. We need an airplane that is designed to do that and the only way to get that is to insist on major improvements to the aircraft in terms of pitch and roll acceleration. In fact, we have been discussing some interesting measures that will be a little better than just plain pitch and roll acceleration.

Probably just about as important as the question of aircraft design for constant maneuver is the question of invisibility. There is just no exaggerating the importance of that and there are only three ways to get the kind of invisibility that is critical which is invisibility to ground guns, particularly ground guns and little tactical missiles which are infrared missiles. The only ways to get that is to have a small airplane, to use camouflage that makes it invisible against the sky background, not just the ground background, and to have an engine that an SA-7 or a Sidewinder missile cannot lock on to. Those are achievable. But we are in fact talking about design. There is an engine available off the shelf that has a very cool exhaust and that will essentially eliminate the infrared missile problem. We are just about there on a real step increase in survivability.

Then there are some other points that I think were already quite well addressed in some of the original A-10 conceptual work, such as reducing vulnerability in structures, measures taken with respect to fuel and so on. I will not belabor those.

There is another important point that I think we have not addressed enough, again due to lack of recent tactical experience, and that is the question of tactics and suppressive fire against anti-aircraft defenses. Once we have a gun fighter that is lethal against tanks, it is going to be extraordinarily lethal against anti-aircraft systems, particularly against anti-aircraft vehicles which are thin skinned, never heavier armored than APC, and just full of ammunition. They should be a far more vulnerable target than a tank and by the use of mutual support tactics, it should, in fact, be possible to make life very dangerous for anti-aircraft gunners. That is a very important element in the survivability equation.

The last and probably the least important of all the survivability provisions, as I think about it, are the survivability provisions with respect to radar. I know in the past we have made a lot of noise about radar cross section reduction and so on. My guess is that we have taken into account scintillation effects and the fact that we almost never see airplanes head on but always from some more or less beamed aspect, not always, most of the time there is some beamed aspect, my guess is that radar cross-section reduction is not worth the

sacrifice that it requires. In any case, it is hard to foresee any radar weapon in division level environment that is likely to be effective against this aircraft.

There are two points on this that I would like to express and that are really important to keep in mind. First of all, that we badly misconstrued and misestimated what the air threat really is like over a Soviet division. And the second point, which follows from the first one, is that, in fact, it is possible to achieve very satisfactory survival in the environment that you are going to see over a Soviet division.

Let me give you a little diagram just to show why we place so much stress on size. This is, of course, by no means the complete size question--we really should be showing front views and side views. I think you can see even just from this plan view size comparison how big the differences in size are among these airplanes. Using the F-5 as our standard, the A-10 is two and a half times the size of the F-5. On the other hand, in the past, the British have built an airplane that is almost half the size of the F-5 and a very fine jet fighter that is called the Gnat. One of the early blitz fighter design studies came up with an airplane that was very similar in size to it, again about half the size of the F-5.

Keep in mind now that the F-5 itself is a large airplane by World War II standards. By the standards of the last time that we did really intensive anti-armor work, the F-5 probably is not a satisfactory size. That is why I stress the importance in these design exercises that we are going through which are aiming for airplanes that are significantly smaller than the F-5.

Now, just wrapping up on these individual effectiveness dimensions that we have been talking about and turning them into an airplane, here is my best guess at what is feasible, based in part in looking at a few design studies and in part on some scratch calculations of my own. I make no claim that these are hard and fast numbers, but I think that they are feasible. I think we can build an airplane in the range of five to seven thousand pounds while preserving the maneuverability that we are talking about, the low-speed performance that we are talking about, we can make that airplane two-thirds the size of the F-5. It would be nice to go further but there would be some difficulty. Of course, it would sacrifice low-speed performance. It is easy to make it half the size of the F-5. In cost, if we stick with roughly the level of technology of say

the A-37 air frame, it should be easy to make it less than 1.5 to 2 million dollars. Of course, on the other hand, that is a big "if". We have had lots of experience in trying to build airplanes simpler than the prevailing fashion and somehow things always get a little out of hand on the cost of them and they rarely turn out as simple as we hoped. In fact, if we were to redo an A-37 today, it would cost a little under \$800,000, including all the inflations from the last time we built it. That gives you a feel for how much margin there is in these cost estimates. An A-37, I might add, is slightly larger than the airplane we are talking about.

As for lethality, as I mentioned before, I think we can probably increase our kills per pass by perhaps fifty percent or maybe a little better.

In terms of performance we are looking for a very wide speed range and one that will be challenging to achieve. We are looking for good maneuvering performance over the range of 150 knots up to a maximum speed of say 450 knots. We are looking for substantially more acceleration in climb than the A-10, at least 75 percent better, and with some luck maybe better than that.

In transient performance, whether you measure it in acceleration, roll acceleration near the stall, or in terms of perhaps a more realistic measure, the time to execute transient maneuvers, I think my estimate of 200 percent is very conservative. I would be very disappointed if we did not get 400 percent improvement over the A-10, just because the size of this airplane and its moments of inertia are so much smaller than the A-10.

Finally, we would like to be able to operate from grass fields or asphalt roads substantially shorter than 4,000 feet, and I mean operate from, I do not mean take-off roll calculations for 4,000 feet. I mean all the safety factors included that we would include in actual operation, and including landing with a loaded airplane to execute this strip alert, ground loiter type mission we are talking about.

I think that some of the features of the kind of design, at least that I have been looking at, are a high thrust-to-weight, if we get just a midpoint weight of 6,000 pounds, we will have a thrust-to-weight of .85 which is certainly a great improvement over the A-10. We should have a wingload that will be very much lower than the roughly fifty or so that people have been looking at. I am looking at a wingload of 30 pounds per square foot on a tailless delta configuration,

that is a thick-wing tailless delta. As I mentioned, we are looking at a very cold engine, the ATF-3 engine, a commercially developed and commercially available engine. If we are going to be serious about a grass-field capability, and I know as painful as it is to pilots who have grown up with tricycle landing gear, tricycle landing gear just is not adequate for landing in a grass field. There are years and years of pre-World War II experience, there are years of crop-duster experience that show that if you are going to land on a grass field, a bicycle landing gear, two wheels, is the only way to go.

A very important capability for the surge sortie rate we are talking about is hot refueling and rearming. The airplane has to be designed to be safe, to be refueled and rearmed, with the engine running.

And, finally, it would be very nice, particularly in the configuration that I was looking at, I think it is feasible with a tailless delta, that there be no external fuel at all. The amount of fuel with the kind of mission we are talking about, which after all are pretty short range missions, is small and there is lots of extra fuel volume. As long as we treat that fuel volume just the way we treat external tanks and do not count it in the structural requirements of the airplane, we will be able to meet these very small airplanes and maybe do away with the inconvenience of external tanks.

Okay, so much for the technical features of that airplane. Let us talk just a brief moment about the program. This is a subject that deserves a lot of discussion and I will just essentially open the discussion.

As we have seen in the past, when we have tried to build relatively simple airplanes, the most critical thing towards any kind of performance for the size and the cost is design discipline and that is something that we all know is very hard to achieve in the atmosphere of the Pentagon and the aircraft development bureaucracy.

I think we have two programs now based on competitive fly-off. Both show, I think, very significant advantages to having had that competition. The benefits were not all that we could have gotten, but both programs went substantially better than our standard prototype and procurement-type programs. I think that needs to be repeated, maybe even improved. And certainly, if we are going to do a fly-off with an anti-tank aircraft, it has to be made on an actual live shooting of those tanks. There should be no ducking that issue.

Very important, and a place where we really got hurt badly on our last competitive development, is the fact that we developed two sets of prototypes, had a fine fly-off, both prototypes were excellent airplanes, both prototypes were combat capable as they grew, they both had guns and IR missiles, and despite that we went into a one billion dollar engineering development program which ruined the airplane. I will not say ruined it completely because the F-16 is still a very good airplane, but they came close to doubling the cost and added about a third more weight and really destroyed a lot of the components that we were hoping for in the airplane. One way or another, this kind of program has to avoid that full-scale engineering development after a competition.

Finally, and this is in a sense the point of today's session, wherever we come out on the design of this airplane and whatever disagreements we have on what is really needed, the critical thing is that we base the design and our discussion on things that are associated with hard combat experience, and not on the promises of the R&D cartel and those endless conversations about how great it is going to be tomorrow. And, of course, that is why we have Colonel Rudel here today, exactly for that reason.

I think it will be helpful if we follow roughly the outlines that we have been talking about here, of the critical aspects of finding and killing tanks. If we follow that kind of outline in talking with Rudel, I think you will be astounded at how much insight you will get into what today's blitz fighter can do. When you sit down and think seriously about what we are setting out to do in building a new anti-armor airplane, I think you will realize just how much insight a man with Colonel Rudel's experience really has into the problem that faces us today. After all, tanks hardly look different from the air today than they did in 1944. There certainly have been no improvements in tank tactics since 1944. I think we are all sadly aware of that, and so we can expect that they will maneuver in the same way, that they will try to hide from whatever threats they have in the same way.

Secondly, we had a long discussion on effective defenses. At least in my view, the defenses today look very little different from the way they did in World War II, with one exception: They will be less dense and less lethal than they were in World War II because all armies of the world have used up so many resources in buying missiles that the gun density will be

substantially lower. The missiles will not be on the battlefield and the gun densities will be lower. And, of course, the gun effectiveness has changed very little. Gun ballistics, which is really the heart of gun effectiveness, has hardly changed at all although it could have. Radar fire controls for guns do not fight in this kind of arena because they do not work against a maneuvering target, they only work against straight and level targets.

What about tactics? I would be very, very surprised if anywhere in the world there were any advances in anti-tank aircraft tactics since 1944. Much more likely is the fact that we have forgotten some of the best tactics we knew then.

What about weapons? This is the one area which has really changed substantially since Colonel Rudel, surprisingly enough. The gun we have today is very different from the gun he used. He had to make do with two 37-millimeter cannon that fired one shot per burst for each cannon, which demanded a level of accuracy completely different from what we need today with our high rate 30-millimeter cannons. So in that sense, we have made progress and we have eased our problem.

And finally, what about the ground battle itself, which is perhaps the most critical determinant of all? Well, it seems clear to me that we have not made much progress in blitzkrieg, in counterblitz operations, or, in general, in mobile armored warfare. And again, just like in the anti-air tactics, we have probably retrogressed to some extent.

Summing all those, I think you will see why I feel that it is so important for us to really probe in depth with a man with Colonel Rudel's experience. I will not belabor his background for you other than to say that beyond the shadow of a doubt, he is the single man in the world who knows most about killing tanks from the air. He personally has destroyed two divisions worth of tanks, several battleships, perhaps a hundred locomotives, and God knows how many trucks and other targets. Probably no other pilot in World War II had as much effect on the outcome of battles as Colonel Rudel, and I do not think there is a better man in the world that we could talk to on this subject. Thank you.

Moderator: Colonel Rudel is not here yet. Let us entertain questions.

Mr. Sprey: Let me say first of all, I have really gone very quickly over some areas which need a lot of discussion. I think for today the most important thing is to have a very thoroughgoing discussion with Colonel Rudel. If there is time afterwards, I will be very happy to stay and we can kick around any of the issues that I have raised here. But for the time remaining let us have some questions.

Question: I was a little bit concerned about the Quad 23 operating in an offensive roll. Do you see that as a threat?

Mr. Sprey: About the same threat as four single 23's. Do you think it is better than four single 23's?

Questioner: Not particularly.

Mr. Sprey: Yes. And there is a lot more maintenance problem because of the tracked chassis. I am not advocating that the Russians get rid of the Quad 23. I do not think it qualitatively changes anything. We have had that thing presented to us as some frightful threat. We know first of all that the ballistics are nothing to write home about. The mount itself is not a particularly good mount and has some problems with recoil. The radar fire control is irrelevant with an evasive target. So why is that such a frightful weapon? We know it is not going to be there in tremendous density. Certainly not in World War II type gun density. I see no reason to be overwhelmed or awed by the threat of a Quad 23.

Question: (Inaudible question about the SA-8.)

Mr. Sprey: You mean Roland-type missiles? We will have to see whether those can really move with the division that has got to cover some territory. I have some doubts. However, I do not think it is a worrisome system because it could be substantially worse against maneuvering targets. It is a beam rider and beam riders have pretty poor kinetics on maneuvering targets. I see no reason to worry about it, you know. It is of course, quite lethal with straight level targets, but we are designing this airplane to not be straight and level ever except when firing.

Moderator: Excuse me. Let me interrupt here because Colonel Rudel has arrived.

COLONEL HANS-ULRICH RUDEL
QUESTION AND ANSWER SESSION

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Moderator: Let us start out with the subject of how they, Rudel's forces, were controlled and oriented prior to the mission, the kind of steps that we are going through, what kind of control they had, what kind of intelligence they had, prior-to-take-off thoughts as a first area of questioning. Then we will go after the take-off to learn how you find the tanks and so on, and we will work our way through a mission with Colonel Rudel.

Pierre Sprey brought up a couple of things about Colonel Rudel. He had more missions than any man in World War II, with 2500 combat sorties. He personally killed 500 plus tanks. The way that was verified was that after he killed a tank, it had to not only burn, it had to burn and explode and it had to be seen by another person in order to have a verification of a kill. Now, Don Tribble is here from Nellis, and we have done a lot of shooting at tanks and one of the things that we found out is that tanks do not necessarily burn and blow up right then. A lot of times that happens five and ten and even thirty minutes later, after you are long gone. So the probability is that there were more kills than that, but that was how it was done at the time.

Colonel Rudel did sink a battleship, at that time the largest ship sunk by air. It reminded me a lot of the movie "Star Wars" because he had to get it down the chimney. In the book he pulled out and it was a heavy high g pull out to the point where he blacked out and he was just above the water at 50 feet when vision came back so he had really gotten close. Let me introduce Colonel Hans Rudel and pass on to him our thanks for being here and then explain the procedure that we are going to have.

We will start out with questions to Colonel Rudel on pre-mission briefings and any pre-mission control arrangements as Colonel Rudel knew them on the Russian Front.

From the floor: Mr. Christie asked Captain Ratley to give a brief run down of the Luftwaffe's anti-tank operations on the Eastern Front.

Captain Ratley: I might just mention how very important it is to understand that there were only two squadrons of cannon-equipped Stukas on the

Eastern Front. There were a total of something like 300 of these JU-87G's built and they were fed through these two squadrons which, of course, had a very sizable attrition rate. Colonel Rudel himself had thirty airplanes shot out from under him, which is a little over one percent loss rate from his 2500 missions.

Question: How did they decide what they were going to do the next day?

Interjection: Just give the rough size of the units.

Answer: There were a lot of Stuka wings and squadrons and so forth, but there were only two units that had the cannon-equipped aircraft; that is with the 37-millimeter cannon under each wing. Each aircraft had two 37-millimeter cannon hung under the wings, one on each side, and they had a clip of six shells in them for each side, a total of twelve. They were supposedly synchronized to fire two shells out at the same time to keep it symmetrical when they were firing.

The two wing-size units' (Geschwader) nominal strength was 150 aircraft (Geschwader 2 and 77 had the cannon-equipped aircraft and each of those units had one enlarged squadron that had the cannon-equipped aircraft. Each on-line string in the field ran about 15 aircraft each, so there were only, at any given time, about thirty Stukas that were cannon-equipped at a time. There was also another unit that was equipped with HS129's. It was a group-size unit and it had at its inception sixty-eight HS129's, which was a twin-engine aircraft with a belly-mounted 30-millimeter cannon. It was a Mark 101 and later a 103 Mauser, similar to the Derlikon KCA which some of you may be familiar with. It carried 30 rounds of 30-millimeter ammunition. All of these used a tungsten carbide penetrator. Any questions on that?

Question: Ask Colonel Rudel if he can remember the date that he first attacked a tank with his aircraft with the cannon on it. Does he remember that time? And was he successful?

Answer: The first time that they had a chance to use the cannon-equipped aircraft was in May of 1943 on a bridgehead down in the Southern Army Group. It

was noteworthy by their unsuccess because the front in that particular area had been stabilized for over a year and a half--very, very firm lines on both sides and the defenses in the area were too formidable for them at that time to use their aircraft successfully. They had an encounter with tanks, but they did not report any kills to their knowledge. However, there were some ships that they did attack.

Interjection: Let me translate directly a very telling phrase that Colonel Rudel just used. He said, "That day we discovered the limits of the cannon-equipped Stuka and we realized that when you attack static defenses, static positions, you cannot have any success." This relates obviously to what we were just talking about.

Question: Here let me insert Tom Christy's question. What time of the day did they start, how did he get his mission for the day, how did he perform his pre-take-off preparations, how many people went?

Answer: Just talking about force size, Colonel Rudel says that going out with a group of more than five to six airplanes was simply nonsense. They just got in each other's way and they started attacking the same tanks and there was no point to it. So he favors tactical formations of no more than five to six. He is talking here about the cannon-equipped aircraft, which you should realize was an extraordinarily unmaneuverable airplane. It was really a marginal war plane. It was a very heavily overloaded JU-87. It was right at the maximum limit. It was considerably more limited in top speed than a normal JU-87 which was not known for its blinding speed, and secondly it was quite unmaneuverable. In general, I think, they were limited to maneuvers of less than three g's with this airplane. So you can see what kind of hindrances they were working with, but the effectiveness of the gun was so critical because it was the only thing they had that really worked against tanks. They were willing to take all these disadvantages and a really poor handling aircraft just to have the gun.

Moderator: With regard to the intelligence that they had in their preparation prior to their attack, they got most of their information from army

units that would report that there were tanks attacking or in preparation for attack in a certain sector. Sometimes they would go there and sometimes tanks would be there and sometimes they would not. They also got intelligence from their own reconnaissance units and again, when the information was relatively new, it would work out and they could go there and find the enemy. Other times, it just did not work out because they had already dispersed.

Interjection: They were being briefed by division-level staff, ground division level staff intelligence was what they were getting.

Colonel Rudel is returning to the subject of the stable front. He said in May of 1943 they really discovered the limits of their weapon. There was a stable front in the south, it was Kunsia (sp. ?), and they just found there was simply no point in attacking that front. It was better simply not to fly, not attack, because all you could hope for was high losses and very few Panzers to show for it.

Question: Let me return to the original question. What time did he start the day out, how was he told, was it radio communications, who was he attached to, where were they located relative to the front, what did they do in the way of preparation for the mission? Can you answer those questions?

Answer: They would attack the enemy tanks as soon as they made contact with friendly units. Sometimes this would be as early as five in the morning or as late as ten in the evening. There was not that much preparation in the way of a briefing or anything of that sort. Everyone was expected to know his job before he got there and as soon as they were contacted and given information about the enemy, they would take off and try and get there as soon as possible.

Interjection: Let me add one thing to that. The normal preparation for a day's operations, and this is from Colonel Rudel's book, was a morning meteorological flight, usually conducted by Colonel Rudel alone, and that was the first flight of the day, take-off was well before dawn and that flight both served the purpose of getting the visibility conditions in the area in which they were supposed to operate and, of course, was a reconnaissance flight and,

in fact, I was referring to the very valuable reconnaissance he was doing, a lot of that was gained on these first morning flights. He would be in touch by whatever means he could either through a radio tank equipped with an equivalent of a forward air controller or, on occasion, as he has described in his book, he actually wrote out a note on a knee pad and enclosed it in a metal capsule and then dropped it on a battalion commander's tent in order to communicate with him that there were tanks in the next village. This was invaluable information. A lot of this was derived from these first flights of the morning, which he called meteorological flights.

Question: Was his mission tasking out of the army or did it come from air force? At what level did it come to him and by what means? Was he told that he was going to be at such and such a point at a particular time with a given bomb load or whatever, a mission load? Was he given those kind of details or was he told, like John Boyd was talking about, "Here's the main activity of the day. Do your mission?"

Answer: The usual request was from Army level to "liege divizion" which was the air division level, although sometimes there was much higher air level, the next two levels up. The critical thing is that the army had no control whatsoever of the air assets. The army could only request. It had no control over the actual air assets. Decisions were made at air division level or these higher levels as to whether Colonel Rudel's squadron was going to be here today and attacking tanks in this area or somewhere else in the front. Of course, the army could state their preferences, that was essentially it. Furthermore, of course, as all higher level staff processes are, that was kind of slow. By the time the word got to Colonel Rudel, the tanks were somewhere else. However, he had a lot of freedom for choosing his own area of operations. It was up to him and the army expected it of him to find where those tanks were by this time. You know, the request might be a day old or more. He based his mission simply on the request and then it was within his authority to find the tanks that he thought had been referred to in the original request. So he had a lot of tactical flexibility about the area he operated in. I might add one other thing and that is that the reason the Stuka units were so responsive, or one of the reasons, is a very

significant thing that you will see in Rudel's book. He never refers to himself as a pilot, he always refers to himself as a soldier and that seems to me a very critical difference in the responsiveness that was actually achieved, even though the ground units he was supporting had no authority whatsoever over allocating his efforts.

Question: I think the question was asked how close to the front they based themselves and what were the facilities they had at the base, what did they require in the way of support coming in to them, and how did they do that?

Answer: Normally, they were based fifty to sixty kilometers from the front but, because of the fluid situation, sometimes around a hundred kilometers.

In some instances, of course, they were much closer, as close as a kilometer or maybe even on the other side. Their normal supplies and fuel were brought up through rail to the nearest rail head and then from there they would be brought directly into the airfield with trucks. In normal instances, they had quite an adequate supply of both supplies and fuel and only very seldom did they use air to bring in any kind of supplies, when there was a critical shortage or perhaps in one of these instances where they were real close to the front.

Question: Did the trucks belong to the Luftwaffe or the Wehrmacht?

Answer: They belonged to the Luftwaffe ground organization.

Interjection: His deliveries incidentally were every one or two days, deliveries of supplies, but every once in a while they would get interrupted because of the situation, then they would eat less.

Question: What was the vehicle for getting these requests. Was it by radio, telephone, or how?

Answer: By radio.

Question: In his book, Colonel Rudel made a reference to frequent moving of the base from position to position in response to the changing ground situation and Pierre also brought it up in his briefing. As this is very important for the blitz fighter, I would be interested in some illumination on what it took to move a base and how long it would take to move it and how they moved it.

Answer: They had no bare base moves. It just was not part of their system. Corps level, air corps level knew in advance that they would need certain bases and did all the provisioning of the bases in advance and this included when they were in the retreat, they would be preparing bases to the rear, knowing that the front would be moving back or lateral moves or whatever. So those would already have munitions and fuel and some ground personnel. Their moves were very fast because they did not have to bring that heavy stuff. They brought essentially crew chiefs and airplanes and started off with borrowed technical people, borrowed maintenance people and then could bring in more of their own if they needed them. So, as far as I can see, the moves were essentially not much longer than the flight time.

Question: That is assuming that they were retreating all the time. When they were going forward they did not have that opportunity. What did they do then?

Answer: Let us amplify that a little bit. They had more flexibility I think than our units do. They would tailor a force for whatever particular operation they happened to be involved in--roughly an equivalent of a wing commander would have reconnaissance units, Stuka units, cannon aircraft, and maybe just straight ground support ME-190's or something like that. Their forces were much more flexible and much more tailored to individual operations than we are.

And they could do the same thing going forward or back. I just used the example of the retreat. But then again when they needed new fields it was not up to them to arrange it. The corps level had to have foreseen that and already had ground personnel on hand.

I have a follow-on on that. One of the reasons why they had to move, of course, probably had to do with the limited range of the aircraft but an

interesting question would be whether even if he had more range would Colonel Rudel have wanted to move like he did just to keep the intimacy with the evolving situation, to be closer to the target. This is the answer to a slightly different question. He was asked whether he preferred to stay with certain ground units and whether that helped coordination and cooperation. He said they did not have that luxury because of course there were so few cannon-equipped aircraft. They had to cover the whole Eastern front with the few cannon-equipped aircraft they had, so they did not get any choice whatsoever about where they would rather fly. He said, however, it did make a lot of difference to them which units they flew with. They knew which were the elite divisions, which were the divisions that had tradition and a really aggressive spirit and had a good fighting record. Of course, this made a difference in how they felt about their flying, and to some extent perhaps the effort, because if they knew that they were just one of the ordinary run-of-the-mill or cannon fodder divisions they knew they had only been assigned there in order to kind of soothe the ground commanders. But when they were with an elite unit they knew their attack and their losses would have some effect, because they would be followed up on the ground, you know, with some results.

This is quite interesting. If he had had more fuel on board and more range he would not have used it to move his fields further back 50 or 60 kilometers but he would have used it in the target area for more search time because that was invaluable to him. He would have liked to have stayed the same distance, the 50 or 60 kilometers, because of the matter of time--time to respond. In case they got an emergency request, or when there was an attack on the front, he wanted to be able to respond in what he thought was a reasonable time and to go much further back than 50 or 60 kilometers would just take too much time to get there. You can calculate for yourself what he is talking about because the Stuka had a cruise speed of something like 140 knots or so.

Question: Would you ask him please what the optimal killing zone was. How far did he range from the FEBA and did he ever engage enemy tanks when German and Soviet tanks were actually fighting and were actually mixed up together?

Answer: We might even start out, could he see the FEBA? He could not because it did not exist. How could he be told where the FEBA was if none existed.

He goes back to Kunsia (sp. ?) which taught him the lesson that as soon as the tanks were within their defenses, you did not want to touch them because you were not going to have any success until they started to move; that is, move out from their assembly positions. In their assembly positions they were covered by heavy flak and you just could not go in there and make six or seven passes on them without expecting really heavy losses yourself. It was not worth it. The time to get them was when they started to move out. As soon as they went into their road march or into their attack formation they would move out 1 or 2 kilometers from their defenses. They were a little careless, they were mostly concerned about the battle itself and the flak was not that mobile. That was the time to get them. Anytime they were back of there, back of the actual deployment for attack, you were going to be in trouble if you tried to attack them. You were just going to take very high losses.

Question: Ask him if enemy air ever interfered with their operations at their bases. Was enemy air a problem?

Answer: He said they had very few attacks by Russian fighters on their own bases to the extent that they rarely used camouflage, the camouflage nets were not a standard procedure because when the Russian fighter pilots attacked their aim was so poor that they almost never destroyed any airplanes. They did not worry about it a lot. There were some elite units--the Stalin Falcons were quite good, but that was just a few squadrons in a huge air force, and so on the ground at their own bases they did not worry very much because even if they were attacked they were unlikely to get hit. Now we are going to ask him the next step of what he felt.

They did camouflage their aircraft by painting them different colors for different times of the year. In the winter, it would be white, and then it would be spring and it would be greenish-brown, and then a lighter brown in the summer time.

Question: I would be curious if he could project or if he could imagine what if the Russian aviators had been as good as he was in air-to-ground and decided to attack his bases, what effect would that have had?

Answer: He says that is a very theoretical question. He says that the real reason that he got to be good was experience. Experience with sortie after sortie after sortie. The Russians generally were shot down after 20 or 30 missions and never had a chance to get the experience. He says very modestly, and I think he is probably falsely and incorrectly modest, he says that he was not any better than the other pilots, it is just that he flew so much longer. That is excessive modesty.

Question: A more basic question is security of the forward basing. Forward basing was very practical, but if the enemy had any kind of a decent air force at all I do not understand how he could operate.

Answer: On that subject of relative quality of pilots and the importance of experience, he says it was clear being there that by the middle or end of 1942 the German Luftwaffe had declined very significantly in effectiveness, in the results they were getting, the quality had declined greatly because a lot of the experienced people, highly trained and experienced people, had been shot down by that time and the effect was very visible. From the end of 1942 on you just did not see the kind of results that you had seen up to that point. That question of who were the experienced and good people was absolutely dominant in the effectiveness of the whole air force. He says he was just lucky, he was one of the guys who was left at the end of 1942. He already had the experience.

Question: (inaudible) This will be the last question before lunch. Make it rather short if you can.

Answer: Sir, to answer your question about the Russian pilots and if they were better what would things have been like he really does not want to address that because it is very theoretical in nature but I asked him. I mentioned that he was obviously not a very good example to take, so how would he find the difference between an average Russian pilot during the war and an average German pilot. As he mentioned, the power the Luftwaffe had declined very seriously after the middle of 1942 because they lost so much of their experience.

However, he said a lot of the difference in the character and the quality of the German pilots versus the Russian pilots was just because of the national mentality of the Russians and their attitudes as opposed to those of the Germans. Where the Russians tended to be more dogmatic and more authoritarian, the Germans tended to be more flexible in their operating methods. Just as a national characteristic.

Moderator: Now that we have finished lunch, I think we can get started again. We have a couple of questions remaining from just before lunch, and we heard some very interesting commentary during lunch and it will probably come up as we ask more questions. General Casey, I believe, had a question just before lunch. He wanted to know whether many Luftwaffe personnel became casualties as bases got real close to the front or even got to the wrong side of the front.

Answer: Colonel Rudel can give you a pretty precise answer on that question. He had a Geschwade of 1500 men and he thinks in four years of war they lost about 30 men--30 casualties due to ground attacks. On various occasions their air field was either within artillery range, and I think on one occasion it was actually overrun by tanks. In toto, out of 1500 men they had 30 casualties in four years of war due to ground action.

Question: How about airplanes?

Answer: He says that at most they lost perhaps 40 airplanes in the entire course of four years of the war due to direct ground action--either artillery on the airport or direct tank fire. He says they lost substantially more airplanes than that due to having to move fast and not having the last washer or tiny part in place so they could not fly them out. They lost far more because of their constantly having to move and leaving the airplanes behind that were not quite ready. And then, of course, as you know their hostile action air losses overshadowed all that. These are very small numbers compared to how many airplanes their wing lost in four years of war because their attrition rates were high and they took them continuously. What I am saying is that the total of all forms of loss on air bases including air attack was no more than 40.

Question: Did they ever get an airplane shot down by a tank?

Moderator: Let us hold off a little until we get into our tactics, but please ask the question then. I am sure they did.

Answer: To answer the other important question from before lunch, Mr. Myers asked if the Russians had been better would it have been possible to operate from bases as close as 50 kilometers behind the front? I just asked Colonel Rudel and he says if the Russians had been better attack pilots and had been better shots in strafing, he says with the addition of very careful extensive daily camouflage such as camouflage nets and so on, plus heavy flak at every base, he said they would not have changed their tactics. He thinks that it would have been quite feasible to continue to operate, and the disadvantages of moving further back than 50 kilometers would have been too strong.

Question: You say he would have added more camouflage and flak protection.

Answer: Yes, he says they would have added in their TO&E more camouflage equipment, and I presume the men to do it, and they would have added more flak batteries.

Question: Do you think he could have operated in the west?

Answer: He says he would have to answer that question with a flat no. They could not have operated in the west because the air superiority of the Allies was simply too overwhelming. Keep in mind that it was not just a quantitative thing, it was also due to the fact that the really first-class pilots of the Luftwaffe by 1943 were pretty much wiped out. Earlier than 1943, of course, as you know over northern France, and so on, the Luftwaffe more than held its own and there was no such air superiority. But after 1943 and by the time of Normandy they had both the quantitative losses and much more importantly the good pilots were gone. Therefore, they did not have the situation of necessary air superiority and therefore the Stukas could not have operated.

Ignoring the factor of the Allied air, he says, in every other way it would have been lovely to operate on the western front because he said the Sherman tank burned much more beautifully than the T-34. The T-34 was one of the finest armored tanks of its time.

Question: What is the secret they used to keep from being shot down by German troops and how much of a problem was that?

Answer: He cannot remember a single loss among the Stukkas to friendly flak. He attributes that to several factors. One was that they were pretty austere equipped with flak in the first place. There was not much German flak. They were concentrating much more on the main ground weapons.

What flak they had was very heavily engaged in anti-tank combat because the 88 was such an important anti-tank weapon. Since they did not worry much about the quality of the Russian pilots, and so on, that was a far more important application. One, there was not much flak. Two, the JU-87 had a very distinctive shape. So distinctive that even the dumbest flak gunner could see that it was German. Third, they had Very pistols that they would fire off and if they thought they had friendly flak firing at them they would actually fire a Very pistol out of the airplane. Lastly the flak gunners were very, very carefully and constantly instructed on aircraft recognition, although in the case of the Stuka it was not so difficult, but other German airplanes were a little more like the Russian airplanes. He was also mentioning during lunch, I might just add, that the pilots were under constant instruction on tank recognition, and always being brought up to date on the very latest Russian models and the very latest German models. He himself in his career thinks that he fired on friendly tanks once or twice; fortunately, without lethal results. Once he remembers he fired at a tank and he happened to be shooting a little high and hit it in the turret which he did not penetrate completely, and immediately a helmet popped out. He was still watching to look for the results and he saw by the shape that it was a German helmet, and the guy was waving to him like that. He felt very badly. He said luckily they had the tungsten carbide round and not the uranium because the uranium round would very likely have set the tank on fire and that would have been bad. But his shot was nonlethal.

Question: Can we get a sense of what the battlefield looked like? I am interested in how many tanks he would normally engage. Was this a division size attack or was it a smaller group of tanks that he would pick up and attack with a flight of five or six airplanes? Is it five or six airplanes against 500 tanks in an attack or five or six airplanes against five or six tanks?

Answer: If you do not make the question theoretical, I think you will get a better answer. If you ask him how many tanks he would see at one time he will tell you. I do not think he could possibly tell how many there were in the attack if he did not see them.

Question: Okay, how many tanks would he see, were they mainly dispersed across country, or were they maybe on roads?

Answer: Difficult question because of the variability, but he will try to answer it.

In those which were huge battles, much larger than any tank battle since, one saw five to six hundred in assembly areas ready for the trip. But they were so defended by flak in static situations that there was simply no hope of attacking them. When the tanks went into the attack out of these assembly areas they would typically be in groupings of 20 to 30, and their spacings would be 50 to 60 meters apart. And incidentally, just as a side comment, that of course is what destroys the effectiveness of cluster weapons. That is too far apart to get much overlap from cluster patters.

Question: About the tanks on the roads.

Answer: He says you have to remember the special quality of the Russian terrain. It is very flat and almost all of it is trafficable with some exceptions and so there was not much need for road. Furthermore, there were not many roads. There are not now and there were not then in Russia and so there was nothing to restrain the tanks to the road. So they would go into attack positions. Even if they were on the road when they saw a Stuka attack coming they would leave the road and start weaving maneuvers as much as possible in order to defeat aiming.

Question: I would like to get back to an earlier statement you made, Sir. Do you actually look for specific areas where the tank is vulnerable. Do you actually aim for those points, shoot at them, and have you found that to be an important factor?

Answer: That was discussed at lunch. Let me repeat the question first of all. For specific tanks did they aim for specific points that were vulnerable. To make it quick I will just give you the gist of the discussion at lunch. Colonel Rudel said this was one of the great differences between the gun he worked with and the new uranium round. The gun he worked with was not particularly incendiary, that is the round was not particularly incendiary and so you had to hit specific areas, preferably always the area that had the ammunition. In fact, they would aim to hit within 10 centimeters of an aim point to really get assured destruction. They were talking about tiny vulnerable spots because of the difficulty of getting a visible kill. Remember, they only got credit for kills that could be seen burning or exploding. He says that is one thing that has changed totally. Now you have the uranium round, and now he says all over the tank there are vulnerable places and you can set it on fire from a very wide area and these accuracy requirements, to hit within 10 centimeters of where you aim, no longer exist. He says that is a tremendous new freedom.

Question: At what range did he shoot?

Answer: 200 meters for him and less experienced pilots would shoot at 400.

Question: I would like to get back to the question of firing on his own tanks--how did he handle recognition and what effect did weather, smoke, and what not have on this?

Answer: Okay, the question of recognition was discussed at lunch. He says the principal thing was of course the constant training of the pilots on recognition of friendly and enemy tanks and the latest models. If it was not clear from some other clues as to which tanks you were dealing with, then as

a last resort they would go to extremes and actually overfly the tank at 5 to 10 meters to make positive recognition because they all understood the very serious impact of firing on friendlies. The incident where he fired on the friendlies was caused by the fact that he had two German tanks right next to a Russian flak gun. It was in very close combat; when he saw the Russian flak gun he figured there would not be two German tanks next to one of those and that is when he attacked, you see, it was a mistake.

Question: Colonel Rudel, in your book you made considerable reference to the futility of cutting bridges. The basic thought was that you cut them well enough but they had portable bridges and they rebuilt them so fast that it just was not worth it--it was not worth the losses and it was not worth the effort. We are putting considerable effort into that today so I was just wondering if he had any thought there.

Answer: He says they attacked bridges as you mentioned and it always took lots and lots of effort to get a bridge, you know, you would have side winds. You would have all kinds of problems in placing the bomb just where you wanted it and it always took lots of bombs and lots of sorties and then finally you would drop the bridge with effort and losses and, lo and behold, the next morning it would be fixed or there would be a pontoon bridge right next to it and all the effort was down the tubes. He says it rarely took them more than half a day to fix a bridge. So, he says, of course there are tactical situations when a few hours may be very important and then you need to attack it despite the losses, but he says as a matter of constant targeting he thinks it is a very bad idea to attack bridges as a regular matter. He said they would figure out exactly how many bombs it would take but that points back again to the fact that they were very resource limited. They had lots and lots of things to do with Stukas and never had enough to go around and bridges just turned out not to be very useful.

Question: Could we explore the impacts of obscuration of the battlefield due to smoke and the impact of artillery shells a little bit more?

Answer: He said smoke was much less of a problem than you might think. Obviously, if a tank is smoked in and he needs to hit it within 10 centimeters of a certain spot he is not going to do it. But he said the typical situation when smoke was used as a tactical measure there would always be three or four tanks that somehow were not covered at the edge of the smoke barrage. They would go after those first. Fifteen minutes later the smoke would be gone and they would go after the rest of them.

Question: Friendly artillery and enemy artillery in the impact area?

Answer: Well, he is talking specifically of enemy artillery putting down a smoke barrage to protect their own tanks. That was the situation he has been discussing.

Question: How about camouflage. Did they try to use camouflage while they were advancing or anything? I am just trying to think of the difficulty of acquiring targets in that arena.

Answer: Right. He said there is a world of difference between moving and standing. Standing, of course, the Russians were masters at camouflage. They would put bushes and what not on the tanks, but he said once they were moving it did not help much to do all that. If you are interested, I will ask him about detection ranges.

He says typical recognition distances for knowing that they were tanks--not identifying but just knowing that there were tanks out there--moving tanks as carefully camouflaged as they could be on a field, not on a road, 400 or 500 meters he said. Pretty close. Even closer than I had expected.

If you used the speed of the A-10 at 900 kilometers an hour, he says, it would be totally useless. You might as well forget about it. You would never see tanks at 900 kilometers an hour. You have to use the low-speed capability of the airplane. That brings up an interesting point that came out at lunch that I think is of major significance here. Colonel Rudel thinks that we have made a terrible mistake in the A-10, and that we would be likely to repeat that mistake in any new airplane, by not having a second seat facing to the rear. He says

there is no question in his mind that if you are going to do anti-tank work you cannot do without that second seat. He gives the following reasons. You must give undivided attention to scanning the terrain in order to find the tanks because they are terribly difficult to find. To do that you cannot be distracted by any requirement to look to the rear or to cover your own six. As soon as you have to interrupt your scanning to look back, you are out of the tank finding business. You will not find them. It will be impossible. Secondly, there is also the issue that if these airplanes have a high-speed capability and the pilot is in some fear that he is going to be bounced he is simply not going to use the low-speed capability and he will be using the upper end of the speed spectrum, the 900 kilometers an hour that he is talking about on the A-10 or on any new airplane. So you must have the second seater to cover six simply to give the pilot security so he will be willing to use the low speed, because if he does not use the low speed he is not going to find the tanks and that is all there is to it. He is absolutely definite on that, just unshakeably firm in that opinion. I think it is something we have to take very seriously. He is talking about this more. He talks about it much more in terms of just seeing than in terms of defense. As you know, the Stuka had a gunner back there and he has not really brought up the question of the effect of having the gun itself. It is just the effect of having a pair of eyeballs looking to the rear.

Question: At what altitude did you make the reconnaissance flights that you mentioned earlier and at what altitude would you normally fly?

Answer: The question was what altitude, what typical altitudes were used for these early morning reconnaissance meteorological flights and what were the typical altitudes used when searching for tanks?

In fairly thin defenses on the morning reconnaissance flight he would fly about 800 meters. If there were stronger defenses he would fly at 1500 meters. Normal search for tanks when he went out on normal attack flights was 400 meters altitude. Then he says if they knew there were tanks down there but could not see them he would look for evidence of tanks. If he saw tracks or something he knew there had to be tanks down there and if necessary they would continue circling and go down to 200 meters knowing there were tanks down there and simply not

being able to find them. They would just keep on circling and circling. After 10 minutes they might find them. Remember they were doing this at perhaps 270 kilometers an hour. There was just no way to do this at any higher speeds.

He said he remembers a typical situation. They would be circling and circling, knowing that there had to be tanks. They could not find them. They would be looking and looking a little more closely at the houses and suddenly they would notice that one of the houses would have this long rod sticking out a window and suddenly they would realize that a tank had driven into the house through the wall on one side and only the gun was sticking out because the tank was too long. He says, with the A-10 at 900 kilometers an hour, how are you going to see a rod sticking out of a window?

Question: Would you get him to discuss the tactics they used to find tanks at night, if they did?

Answer: There were in the Luftwaffe specialists for night attack and there were specialized night-attack airplanes that were used to go out to try to find targets. Colonel Rudel does not think much of their effectiveness. He says basically their main effect was to spoil people's sleep but they would not have any effect. He said the job was so tough in the day, the job of just finding the tanks, that the night business was completely hopeless--was and is. Another reason they did not go on night operations was because they got very little sleep, particularly in the summer when the days were long. They were up much more than an hour before dawn and they were flying until last light, and it was not humanly possible to fly more than that. Furthermore, he said the Russians did not normally operate at night so there was not much need.

Question: In view of the fact that he flew 2500 combat missions in a little over four years he obviously flew in pretty bad weather. What were the limitations on ceiling for your missions and the visibility distance?

Answer: He says if the ground forces were really screaming for help in a very serious emergency then they would be willing to fly at 50 meters ceiling and 600 meters visibility and make attacks under those conditions. He says,

however, that you knew in advance you were going to get heavy losses, naturally. But they were willing and able, and did fly, and did make successful attacks on tanks at 600 meters visibility and 50 meters ceiling.

He says you have to remember though that the climate in Russia is continental climate. It is not the same as central European climate, say. The incidence of bad weather was relatively less than you would expect in Europe. They had generally better weather, but those were the limits in Russia, those were the limits he flew against.

Question: That brings up the question of navigation. In bad weather did he have severe navigational problems? How did they get to the target--did they have a leader?

Answer: Well, you know you cannot find anything without an inertial. We might pursue that a little bit about the flight leader. How they did it with bigger formations. Colonel Rudel says that he flew 2500 combat missions and on every single occasion, 2500 times, he was always afraid he would not find the field. He said, however, he did find it on 2500 occasions. But that is not necessarily true of everybody. Other pilots did have to make emergency landings because that was not particularly serious, you know, because you could land almost anywhere in Russia. You could always find a place to land. But he says Russia was particularly difficult from a navigational point of view because the country was so uniform and the chart material was terrible. He says they had terrible maps. Very inaccurate. And in winter it was really bad because you could not even find the railroad tracks in the winter. Either you would have just unbroken woods or unbroken open fields. It just made navigation very tough and so he said he flew rigidly by compass and clock. Absolute, as precisely as he could, and 2500 times he was afraid he was lost and 2500 times he would get back to the right field. He attributes a lot of that to experience. Experience made up for the navigational difficulties that he might have expected. But we will pursue what the role of the flight leader was in finding a target.

He always made sure to have an experienced pilot to lead every formation and that mostly solved the navigation problem for them.

You see there was always the problem of bringing in inexperienced people because of the high attrition rate. They always had a substantial number of inexperienced people to do the formation leading.

He says he has no experience with inertial so he cannot comment.

Question: I guess my question was that if he had had that capability, does he feel it would have resulted in a significant improvement?

Answer: I asked him if he had an instrument of say 6 to 10 kilometers accuracy, roughly, at our current level of inertial accuracy, would it be useful? He said, sure, if somebody gave it to you it would be great. He says, of course, you have to remember that it also strengthens the laziness of your air crews.

Question: (Pertaining to his supposedly getting an expensive inertial navigation unit.)

Answer: He said of course in Germany people normally say America is so rich they can buy anything, and he says if that is really true, sure, he says, buy inertials at \$200,000 each and pay a price, whatever it is, 10 percent in sorties or something. But if it was up to him and if the real truth was that you do have to consider cost, then he says no he would not be interested. He would much rather spend the money on training.

Question: On this experience question, after him what was the experience of the air crew in terms how many sorties they had been on?

Answer: I will break the answer up into two parts. One is the question of combat experience. The next most experienced pilot on the Russian front had 1400 attack missions. The next one after that had 1300 and then there were 10 or 12 who had over a 1000. So you can see there was quite a leap even from the largest of those to Rudel's 2500 missions. A lot of those were not equipped with the cannon-equipped Stuka, they were flying bombing Stukas. The highest scoring tank-killer after Rudel had 900 sorties, combat sorties, and shot up a hundred tanks. The next best after that shot up 70 tanks, and then there was a group of

40 to 50. Of course, you are talking about a relatively small group of pilots, all those pilots who went through two squadrons which had the cannon-equipped Stukka.

Question: Could we get into the question of tactics--the attack formation. Did they attack in trails of several aircraft or did they come from different directions. Did they try to attack the rear of the tanks?

Answer: I will ask him that question. Let me first give you a wrapup of what he said during lunch. I think Tribble asked him what the best formation would be--what the best size of formation would be for attacking tanks. He said if you have the quantity of ammunition you are talking about in the A-10, he would not want to take more than two people per attack mission because you have so much ammo you do not need the others along. At most, he would take three. But certainly beyond that you would just be getting in each other's way. Then the question was asked since the A-10 is a single seater with nobody covering your rear, does that modify your views of how many people you ought to have along. Then he says, if you have the luxury of pilots in your attack squadron who have air-to-air experience, who are well trained in air-to-air, then he says he would probably feel that the best unit to go out would be four A-10's to fly air cover and still no more than two at a time to be doing the attacking, four watching and two attacking. You see why they feel so strongly about having the guy in the back seat. He thinks he needs four just to make up for the lack of the guy in the back seat. I will continue with your question now though about the specific maneuvers and attack formations.

Question: In your question would you ask him how much communication there was between aircraft during those maneuvers, and so forth, in the target area.

Answer: We will ask him also about the communications just prior to the attack and while the attack was going on.

He says if we were flying in two's he would assign one tank or group of tanks to his number two man a few hundred meters away from his own. They

would attack them independently. But he says, however, that has a tremendous drawback if you do that in the A-10 because you have nobody covering your six. In the Stuka it was perfectly feasible and was not any problem because you always had somebody watching your rear. But you would have to balance that in the A-10. In general, the unattractiveness of having two airplanes fire at the same target is very great. It is silly and it is a waste of ammunition. You know he feels very strongly about ammunition because he only had six bursts of two each on his airplane, so he is very economical about that. His preference is to fly separately. His preferred dive angle, if everything else allows, would be 20 degrees.

Question: Would you ask Colonel Rudel what the FEBA looked like as far as depth and also the silhouettes that the tanks presented. Was there any uniformity at all or was it a mix?

Answer: Well we went round and round on that subject at lunch time because there were some people who were very keen to know about typical distances. The question at lunch was how far ahead of friendly troops his typical attacks were. He was very reluctant to answer that question. He did not like the question. We kept on insisting and finally he said first of all a lot of time he would attack behind friendly troops because a lot of their missions were against tanks that had broken through. There was no question of being in front of them. You were behind them. And then things were very, very confused. Those were the toughest recognition situations, because friendly and enemy tanks were just totally intermixed and there was no telling which was which by position or anything else. From a defense point of view that was a good situation--from a flak point of view--because these tanks had outstripped their defenses. That is when he could overfly them. For those situations where there was not a breakthrough where he really was somewhere ahead of his friendly troops, he said the average distance, again he was reluctant because it varied so much, but the average distance at which he would attack tanks was maybe 3 kilometers in front of friendly troops. Again, his preference was always to get tanks that were moving out of the assembly area. The assembly areas were tougher. Of course, if he would see the tanks there and if the defenses were not too bad, of course he would shoot them in the assembly areas too.

Question: What I was really interested in was the appearance of the Russians' FEBA. In other words, how much distance might there be between the forward or leading tanks and the lagging tanks, all of which theoretically should be in a nice straight line?

Answer: He says it is very difficult to answer, but in terms of what he saw he would say perhaps there would be 500 meters between the furthest forward tanks and the last tanks in an organized assault.

Question: And what would be the silhouette appearance of the various tanks? Would they all be uniformly presenting the same aspect or would they be heading in different directions?

Answer: He says first of all that if they were inexperienced, if they had never been attacked by Stukas, they would try to hold a parallel formation. Now remember this is in Russian terrain on the flat fields. They would try to hold parallel formations. If they had Stuka experiences, if they had been attacked before, then they would just break wildly in all directions. And if you looked across a wider front, a division front, again in this terrain, he feels they were mostly trying to adhere to a rigid parallel attack direction. But of course that is completely conditioned by terrain.

Question: In situations where there were some defenses present, did he still have the latitude to determine his attack azimuth on the tank or was he constrained to attack from certain aspects?

Answer: He says the main effect of increasing defenses was that they required very hard maneuvering approaches. He said there were only two possibilities: either you jinked constantly and very hard coming in and used just the tiniest amount of tracking time to fire and get out; or, if you did not have the experience you could not fire and hit from such a jinking approach and tried to come pretty smooth and level, he says then you would get shot down. That is all there was to it. If you did not jink you would get shot down, this was just guaranteed. It was on or off--that simple. If you jinked hard and you

were good at it you could survive. Now, not everybody could hit from such a jinking approach with such a tiny amount of tracking time, but with experience you could do both. You could come in, jink, survive, track for a very small amount of time and get good hits. Hit within that 10 centimeters that you had to. Secondly, he said they normally did not change their attack direction because of the presence of flak. They preferred to attack from the rear. For them there was a bigger vulnerable area from the rear into the engine or into the back of the turret. If because of where they were and they wanted to attack directly, the other preferred attack was from the side. That was harder because the vulnerable area into the munitions from the side was quite a bit smaller, but they would attack on occasion from the side and try to aim for just that spot where they knew they could get into the munition containers.

Question: What would the effect have been on his operations if it had been necessary for him to fly no higher than 100 or 150 meters?

Answer: He says if you had an upper ceiling of 150 meters due to guided missiles and the same defenses they had in Russia, it would have been totally impossible because the guns would have gotten you for sure. You had to have the flexibility to come up higher in the areas where you were uncertain as to whether the guns existed or did not exist. I think that is an important comment because of our recent obsession with low-level tactics. I think low-level tactics are a very important part of the repertoire, but there are places where they are obviously impossible, and where you want to fly at 800 meters instead of 150 meters or 20 or 30 meters as he did many times too.

I think there was an earlier question as to what kind of flexibility the squadron or wing commander had in picking targets, and so on, and Colonel Rudel has answered that question at a previous session. I will give his previous answer, then I will ask if he has anything to add. The German command in that respect was very flexible and they took into account the experience of each commander. For instance, Rudel himself was given very wide latitude. He was never told the coordinates of targets. He was just given the most general kind of guidance about what unit he was supposed to help and what problem they had and then the rest of it was up to him. Of course, he had a lot of experience. He

knew exactly what kind of attacks the Russians were likely to mount and where the critical points would be, and so on. However, with squadron commanders or wing commanders of decreasing experience, the tactical initiative allowed them by the air division would decrease, and the greenest squadron commanders would be given quite specific target coordinates.

He adds to that commentary that very often they would attack a different target than they were assigned and they would tell the army, "We just attacked tanks over here by this village instead of over there because these tanks were further ahead than the others". They said the army was always very happy because they had very short range vision. They only see a limited part of the world and if he was in a position to know that they were more closely threatened by another group of tanks he would attack it and they were always very happy with his results.

If you had a completely green squadron commander, if he was told to attack tanks at such and such a point, such and such coordinates or village and he flew out there, if he found the tanks he would attack them. If he did not find them he would go home. They did not have any authority really to go out and then search and sweep.

Question: That brings up the concept of FAC's. Did they have such a thing as the FAC?

Answer: Yes, I will give you the answer from our previous session last year and then I will ask him to add to it. I will answer both those from last year. First of all, they did have a forward air controller, non-flying but Luftwaffe, who rode in a radio tank. They had to take the gun out of the tank and install radios instead. They were pretty scarce. Normally something like one per division and he had the right radios to talk to the Stukas and would relay the needs of the division that they were supporting and, perhaps, even more important, receive the reports of the Stukas on what they had seen. This was the visual recce that I referred to earlier. Colonel Rudel recounts one incident where an armored division commander was down to this last half-dozen tanks and announced in public that if he was down to his last tank, his last tank would be a radio tank. He would take the gun out. He would put the radios in because the value of the information he was getting from Colonel Rudel and

his observations on where the enemy was and where the greatest threat to him was were more valuable to him by far than his last tank.

Question: That sounds like a liaison officer instead of a FAC.

Answer: I will ask the question but you have to remember of course, that Colonel Rudel had an unusual amount of authority. That fact may have had a different position relative to a greener air commander.

The general's name was General Unhein, who is still alive, who made this public comment about the value of Rudel's reconnaissance information. The title is "Fliegerverbundungs offizier" (FlieVO) which means flier's liaison officer. He was really a liaison officer as best I can tell. He was really subordinate to the ground. He had to pass what the ground wanted on to Rudel or to any commander. The division commander wanted to tell his air support, "My problem is such and such", or, "I absolutely want you to attack over here", or whatever. The liaison had to pass that on and likewise he passed on whatever information Rudel had. He apparently had very little authority and he was nonflying.

Question: I would like to explore the nature of the threat at low altitudes as we referred to earlier and the reasons they did not spend more time operating at very low altitudes. Was that largely from dedicated AAA or was that from just machine guns on tanks and other vehicles?

Answer: Let me say first of all Rudel is talking strictly about being very adaptive on the question of what altitude you fly at. He says any time that they started to get the sense that there was not much flak around they would simply descend in altitude, go down to the best altitude for search. They would start off at 800 meters because they were uncertain. If they did not catch a little fire for a little while they would go to 400 meters. If they did not catch any fire there they might even go a little lower. But it was constantly a question of probing the defenses and then of course, the very important point of being absolutely current on the dispositions of the defenses and again I will bring up a point from last time. Rudel said that critical to survival was to be there all the time and to be in total constant touch with the current front situation. He

said the most dangerous thing you could do was go home for a week's leave. He said when you came back after a week's leave the front situation had changed so much and you were out of touch with it, that was the time you were likely to blunder into a very strong flak position. It was critical to be right on top of the very latest information on dispositions and to have personal knowledge of it. Just to be briefed on it was not good enough. I will ask him the other question now.

He started off with a German saying which literally translated is "With enough hounds the hare is dead". He said if you ran into some place where everybody was shooting everything, you were going to take a lot of hits. Each hit might not be that dangerous; he came home often with 50 hits in the airplane. It was not uncommon at all, but if one of those was in the radiator he had seven minutes to get down. But he says you never know what the exact causes were and which was the most dangerous, whether it was the specialized flak or the ordinary machine guns. But certainly ordinary machine guns could bring down Stukas, particularly with these hits in the radiator. That is what they were most afraid of. Furthermore, he says it was very dangerous for them, and very uncomfortable when the flak would fire without tracer. When they fired with tracer, it was great. You could always evade and go up in altitude, but if they were firing without tracer you were flying along fat, dumb, and happy, thinking nobody was shooting. It was very dangerous. There is an interesting point for tactics of anti-aircraft. Since everybody shoots with tracer, tracer is the right way to do it.

Question: Did he ever run into any communications jamming or any of that kind of disrupting communications or false information being passed to them from the ground?

Answer: He heard some noise on his communications channels. He heard no deception conversations in his experience. And in fact, he said it is very important to remember in this connection that they were very rigid about communications discipline in the Stukas because they believed that all you had to do was talk a little and the fighters would be on top of you. Okay, so they just did not talk. There was no chatter. Absolutely no chatter and if they

could assign targets or whatever without conversation, all the better. There was absolute minimizing of conversation because they knew it led to losses. On the other hand, he said the Russians had no discipline at all as far he could tell. There was just constant chatter on their channels and he had a man in his squadron who was born in Vilna who could understand fluent Russian and who said they were always yelling on the radio, "Attack the first one, attack the first one. Because it's Rudel who's shooting up all our tanks".

Question: Did he have any problems of discipline with his noncommissioned pilots or between them and the commissioned pilots?

Answer: He says his experience is limited to his own units and he says in his unit there was no discipline problem, so they did not have any problem between NCO's and officers. The discipline in his unit was as good the first day of the war as it was the last day. He says, however, it was different in fighter units. A lot of the air-to-air fighter units had poor discipline, particularly towards the end of the war. Discipline really started to break down in those units and he does not know whether under those circumstances certain frictions or problems developed between NCO pilots and officer pilots. He cannot comment on that. For his own unit he can comment. There were not any problems.

He says he will venture a general opinion beyond just his unit. In general he does not see that having good quality NCO's is any problem, in fact, he is for it. And you have to remember that the ones that he dealt with had mostly at least 8 to 10 years of service. Some had 12 years. And they were good soldiers. He emphasizes the word soldiers. Then he says even more so in the coming war with the Russians. If you want to conquer the Russians, he says the first quality that air crews have to have is they have to be soldiers; the second quality they have to have is to be soldiers; and the third quality they have to have is to be soldiers. And then, at some much higher or much lower level of priority, they also ought to be pilots.

Question: How does he rate NATO and how does he think the German and U. S. air forces would stand up against the Russians today?

Answer: He says first of all that he thinks in general the German Air Force has become commercialized or materialized and that lots of the personnel are more interested in a little more leave, or a little more privilege, or material things like that. And he says against the Russians that will not do. That just will not do. The question of spirit is absolutely the first and most critical thing and he feels that has declined--declined substantially. Of course, there are exceptions, naturally. And he just hopes that the Americans have not had that kind of decline and that they have the requisite spirit with which his unit served in the war--this idealism and dedication is essential.

Question: Ask him if he is familiar with Sturmovik and if so, how would he rate that in some kind of reasonable sense that you could understand relative to Stuka.

Answer: And then we will take one more question and that will be it.

He says the Sturmovik had one great advantage and that was that 20-millimeter flak just bounced off it. It was very heavily armored and it flew and it survived beautifully against 20-millimeter flak. Inside it was extremely primitive, I mean really surprisingly primitive. Just all those things that the Americans do 150 percent better and maybe too well, he says the Russians did not do at all. It was really primitive. The Americans, of course, do it much more expensively, but the airplane was a perfectly respectable flying machine and very survivable. The main problem was the crew of the Sturmovik. The crew was not very good. At most, 10 percent were in any way competent; 90 percent would just fly blindly right into the flak and just get shot down. Just shot down in droves. Just no idea of what they were doing and just get shot down. Then the other thing is of course it had no anti-tank weapon. It was strictly a dive bombing airplane for whatever targets were addressed by dive-bombing then.

Okay. One more question.

Question: Pertaining to the availability of aircraft and experienced pilots during the war.

Answer: He says, of course, each one of these was a problem at one time or another. Essentially, he never ran out of gas. Essentially, gas was

no constraint on their operations but it had a lot to do with the quality of people they got, because there were so few flying hours given these people, so little gas given to train them, the people that he was getting late in the war, we are talking about late 1944 and on, he said it was astonishing that they knew how to fly at all. If he had to enter the war on the amount of gas they had to fly, he certainly would not have known how to fly when he got to Russia. And he said it was astonishing and a tribute to them that they could fly at all when they got there. He was always surprised that they did as much as they did with so few hours. But that of course, really hurt because with people that inexperienced, they would get shot down right away and they never had a chance to build up the experience to become really effective and good. On aircraft, he never ran out of aircraft. For perhaps a week he would have a shortage of an airplane or something that had not arrived yet. But he says that may not have been the general experience on the Eastern Front because he got high priority. By that time in the war he was certainly the most famous German pilot of all and the whole system would bend itself to the maximum to supply him with airplanes. I am adding that as commentary. He did not say that. He just said you have to remember he had special priority and other people might have had shortages. He does not know.

Moderator: I think that wraps it up. Colonel Rudel has been very patient with all our questions and our lack of experience in Panzer warfare. Every time that I have talked to Colonel Rudel I have discovered completely new insights, and I am sure we have not even gotten close to the bottom of what he knows about attacking tanks with airplanes. On behalf of all of you I would like to thank him for having been so absolutely forthcoming with his views and, in my opinion, very rigorously objective. Thank you very much, Colonel Rudel.